



FRIDAY, OCTOBER 24, 1902.

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Contributions

The Valve Gear of the de Glehn Compound.

Philadelphia, Oct. 20, 1902.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with great interest the article by Prof. W. F. M. Goss on "Possibilities in American Locomotive Design," published in the issue for Oct. 17. In speaking of the valve gear employed on the French balanced compounds, it is implied that, for the inside cylinders, a motion similar to the Stephenson link is employed, and a radial motion used for the outside cylinders. As a matter of fact, the Walschaert motion is used on both sets of valves, the only difference being that those for the outside cylinders are driven from an arm on the rear crank pin; while for the inside valves, an eccentric is necessarily employed, there being, of course, one on each side, between the journal box and the crank disc. Only two eccentrics are between the frames, not four, as mentioned in the article referred to.

I presume that in the Walschaert gear, the rod driving the valve is radial to the link, thus bringing this motion within the class known as "radial gears"; although the Walschaert gear is certainly very different from either the Hackworth or Joy motion, which may be accepted as representative types of simple and compound radial gears, respectively.

There is an error in the column headed Locomotive Building, which, in these days of very heavy engines, is perhaps too self-evident to require mention. The statement is made that the Chicago & Alton has ordered two small Pacific type engines from the Baldwin Works. On the contrary, these will be exceedingly large locomotives, with the 4-6-2 wheel arrangement, which the Baldwin Works call the "Pacific type."

PAUL T. WARNER.

[Our "copy" for the item about the Chicago & Alton locomotives read "simple"; the printer improved it to "small."—EDITOR.]

The Proper Curvature for a Filled Arch.

Wanette, Okla. T., Oct. 6, 1902.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of Sept. 12, in an article on "The Proper Curvature for a Filled Arch," the author presents some able and scientific ideas for arch designing. They are certainly in advance of the common theories which have been used to draw the line of resistance for an arch. Evidently with the increasing use of the arch these old theories are being replaced by methods which are more certain and which are based on fewer assumptions.

Mr. Luten says: "The effect of the live load upon the curve of equilibrium of a masonry arch is very slight as compared with the weight of earth fill."

I think the transformed catenary would answer for the equilibrium curve upon which to design the section of such an arch, where the live load is small as compared with the dead load. But the live load is not always relatively small. In flat arches, and especially in Melan arches, the reverse is often the case.

The writer has designed several arches for railroad use where the effect of dead load was small compared to the live load. In these designs the method of elasticity was used. This method has been compiled by several writers so that it is convenient for practical application. It is perfectly general and adaptable to any form or any loading of arch concrete, steel or combinations. Models, one-twelfth size, of the arches referred to, were tested to destruction and loading, deflections and position of the points of fracture bore out the theory on which the arch sections were designed.

In view of its general applicability I think the elastic theory is preferable, for arch design, to the method described by Mr. Luten.

Incidentally it may be stated that several of the arches referred to by Mr. Luten were designed by the elastic theory.

L. K. SHERMAN,

Resident Engineer A., T. & S. F. Ry.

Electro-Pneumatic Interlocking at Albany.

[WITH AN INSET.]

The New York Central & Hudson River Railroad has just completed the elaborate new switch and signal plant at the Albany passenger station, which was briefly noticed in the *Railroad Gazette* of July 11, and we give on the inset herewith diagrams showing the tracks and signals. The western extremity of the new signaling appears at the left hand end of the upper drawing; and the eastern extremity, which is at the passenger bridge over the Hudson river, appears at the extreme right of the lower drawing. The right-hand end of the upper joins the left-hand end of the lower drawing. This is not only a very complete and well designed plant, but the drawing and its lettering are also particularly clear and easy to be understood. All of the eight tracks in front of the passenger station have track-circuits for controlling the signals, and the limits of these track circuits have been indicated on the diagrams by drawing the rails in heavy lines. With these track circuits throughout the length of the yard, the home signals are locked in the stop position whenever any part of such electrically protected track is occupied; but there are short semaphore arms not controlled by the track circuits, by which switching movements are permitted while the home signal stands at "stop."

The apparatus is the Westinghouse electro-pneumatic, put in by the Union Switch & Signal Company, under the direction of Mr. J. C. Irwin, signal engineer of the railroad company. (Mr. Irwin has lately resigned this position and gone into the transportation department.)

The signaling of the Delaware & Hudson, which is controlled from the cabin on Montgomery street near Livingston avenue, constitutes a separate plant, which is worked by the low-pressure pneumatic system. The tracks to and from the D. & H., at this point, are traversed by the Belt line trains running between Albany and Troy.

The signals worked from the D. & H. cabin are indicated on the diagram by showing foundations for the posts. On signal X B the upper arm is a New York Central signal, while the lower is a distant signal worked from the D. & H. cabin. The track circuits extending from the New York Central territory to the point where the D. & H. tracks are crossed by the "Bull Run" track are put in by the New York Central.

The tracks lettered T, U, X, Y and Z (see signal 24 R, 420 ft. from tower 1), which connect with the freight tracks from the west and lead toward the freight bridge over the Hudson river, are carried above the Delaware & Hudson tracks; and Livingston avenue and Montgomery street run beneath all of the tracks.

Tower No. 1 works the switches and signals from the west end of the yard to a point 1,061 ft. east of the tower. Tower B controls from this point to signals 20 and 22, which are 892 ft. east of Tower B, and Tower A controls from this point eastward to the passenger bridge.

The indications of the various signals are shown by the notes on the diagrams. To provide for running trains at good speed fully up to the platforms, while at the same time affording convenient signals for switching, the entrances to the yard from both directions are provided with three-arm signals, as mentioned above; as for example, signals 16 L and 18 L, 513 ft. east of Tower A. On this post the upper arm, 18 L, gives a clear route to any one of the five main westbound passenger tracks, all of these being reached through easy curves, suitable for good speed. The clearing of the signal for a track which is already occupied is prevented by the track-circuit lock. The second arm, 18 L b, indicates the route over the crossover track from Y to V. The third arm, 16 L, is for switching movements, and gives a clear route only to the next dwarf signal, 20 L or 10 L. This lower arm, 16 L, gives its go-ahead indication at night by a green light, meaning a slow movement; and when the arm is horizontal the light is blinded, so that it shall not confuse a runner approaching at high speed. This arm is similar to the English calling-on signal and is like it in arrangement and function. Signal 20 L is for low speed

movement only, and, like 16 L, is blinded at night, when the arm is in the horizontal position. The low speed signals are not controlled by the track circuits.

The machine in tower No. 1 has 31 working levers and four spare, controlling 21 switches and 39 signals. The machine in tower B has 43 working levers and four spare. This machine works 21 switches, four double slips, 49 signals and six pot signals. The machine in tower A has 18 working levers and three spare, controlling 10 switches, one double slip, one bridge lock and 29 signals.

A Review of the Master Car Builders' Convention of 1902.*

During the last year the Western Railway Club contributed to the literature on the construction and maintenance of cars, papers and discussions on the M. C. B. coupler, maintenance of air-brakes, the bolster problem, springs, brake-shoes and draft rigging, and also our idea as to what modifications should be made in the rules of interchange. This literature has been spread broadcast, and we have made our contributions to the general good in accordance with our articles of faith. Other clubs have done the same, and we look to the Master Car Builders' Association to see if the seed thus sown has been productive, and therefore, a brief resume of the work may be of interest.

At this year's convention, not so many questions were ordered submitted to letter ballot, as in former years; the reports of committees were more in the nature of progress, their work not having been concluded.

One of the new features of the convention work was the appointment of a committee to consider recommendations made in the President's address. In past years the presidents have given their observation on the year's progress and have made recommendations which would be of value to the Association if followed to a conclusion, but they have been lost track of in the consideration of the regular programme.

The Committee on Supervision of Standards reported some minor changes for adoption. It will be noted that certain of the changes have been proposed by sister clubs and have been favorably considered by the committee. Several of the recommendations submitted by the committee were to transfer some of the recommended practice over to standards, the probationary period having proven them to be worthy of adoption as standard. Among these are the air-brake defect card, the gage for locating wheels on axles and the air-brake hose label. The recommended practice regarding the size and location of steps, ladders, handholds, etc., was modified somewhat and adopted as standard. Some objection was made to the change in position of the handhold on the roof of the car over the top of ladder from that parallel to end of car as heretofore, to that of longitudinal with the side of car.

The wedge stop lugs in the 5 x 9 and 5½ x 10 in. journal boxes were increased in size to secure uniformity and greater strength.

A new method of stenciling cars for the location of defects and their repairs was adopted.

One thing brought out in the discussion of this report was the desirability of knowing to just what extent the standards of the Association are being used by the railroads of the country. It is hoped some means will be developed whereby this information can be obtained.

The question of the maintenance of steel cars was touched upon very lightly, owing, no doubt, to the fact that they have not been in use long enough to consider their maintenance except the damage due to accident. It developed that in the repairs of these cars no specially skilled labor is required; that the work is being performed by the ordinary car repairer.

The report on triple valves indicated a growing necessity for the introduction of an automatic method of securing increased braking power on cars, so that the power available will be proportional to the weight of the car whether loaded or empty.

The report of the committee on M. C. B. couplers was one of the reports indicating progress. Its principal suggestion was in reference to the abandonment of the link pin hole and link slot. The only objection now to this action seems to be in the handling of cars around sharp curves in yards and on off floats at tide water, but it was thought that with the introduction of satisfactory devices for overcoming these local inconveniences, a very great advantage and saving would be gained all over the country by the abandonment of this pin hole and link slot. The Association adopted the following resolution:

"Resolved, That the Master Car Builders' Association recommend to its members in purchasing M. C. B. couplers, that they specify that the link slot and link pin hole in knuckle shall be omitted, and in that connection, that the standing committee on couplers shall make an inquiry and report to the convention next year the results obtained by that change."

This inquiry the coupler committee has made by a circular letter to the members of the Association.

The question of a coupler for high capacity cars has been carefully considered, and while the committee did not make any definite recommendation, it is of the opinion, from its present experience, that a head 11 in. or 12 in. deep with a 9 in. or 10 in. face for a solid knuckle, the contour of which should be changed to admit the use

*Extracts from a paper read before the October meeting of the Western Railway Club by the Secretary, Mr. J. W. Taylor, also Secretary of the M. C. B. Association.

of a 1½ in. pin will meet all the requirements of the heaviest service, but another year's service is necessary before anything definite can be recommended.

The establishment of a coupler testing plant at Purdue University, LaFayette, Ind., so designed that it can be made available for testing draft rigging, axles, etc., was approved by the Association. When this plant shall have been completed, Purdue University will be well equipped for making tests of different parts of cars, as the Master Car Builders' Association already has installed at that point an air-brake test plant and a brake-shoe test plant, both of which are available for test purposes under the same conditions as for the coupler testing plant.

The inspection and cleaning of triple valves and brake cylinders was presented through a report of a committee, in which it outlined in detail proper methods for taking care of these parts of a car. These rules were adopted by letter ballot as a recommended practice of the Association. A copy of these rules should be in the hands of all who have to do with air-brakes.

One of the principal questions considered, in which we as a club are concerned, was the revision of the Rules of Interchange. The report of the Arbitration Committee to the Association contained the approval of most of the recommendations made by this club and were finally adopted by the Association. One suggestion which was the subject of considerable discussion and in which this club is interested, was proposed by Mr. Rhodes and refers to a modification of Rule 2, as follows:

"Loaded cars offered in interchange must be accepted. If not in safe and serviceable condition, the receiving road to transfer the load at its expense."

The draft gear committee presented a voluminous report detailing a series of tests of draft gear which it had conducted during the year. The discussion carried with it the suggestion that while the tests were valuable in developing the quality of the material and the detail designs that go to make up the draft-gear and attachments, the ultimate solution of the draft gear question must come from tests under actual road conditions. The draft gear committee has already taken steps looking toward a record being kept of the cost of repairs of draft rigging, and it is hoped that those of our members who are members of the Master Car Builders' Association will heartily assist the committee in this work, so that we may know what it is costing to keep up the various gears in service.

The subject of Side Bearings and Center Plates was a report of progress. As to the merits of anti-friction side bearings for relieving the center plate from part of the load, the committee expressed the opinion that with a center plate of proper design and material and a truck and body bolster of sufficient strength, the load can and should be carried on but one bearing point, namely, the center plate. This committee has some interesting experiments in hand, and an unusually valuable report may be expected next year.

The cast-iron wheel was the subject of a committee report, but nothing very definite was obtainable. The committee believes that the information on the subject of wheels for heavy capacity cars is very indefinite and fragmentary, and that it is brought about by insufficient experience with cars of that capacity, and asks the members to keep a careful record of all breakages, giving (1) weight of wheel, (2) capacity of car, (3) character of

A discussion on the subject whether there is any economy in fitting up yards with air pipes for testing and charging train pipes before engine is connected to train, indicated that all division terminal yards, also yards at large interchange points, should have air pipes; that the installation of such air plants will not only be found necessary but economical. As to whether it was good practice to test the air-brakes in a train immediately upon its arrival at a terminal or when made up ready to leave the terminal, it was the consensus of opinion that after the train was made up was the proper time to make such tests.

To complete the story, as a result of this convention the Executive Committee of the Master Car Builders' Association has already mapped out its progress for the coming year. The standing committees on Arbitration, Standards, Triple Valves, Brake-Shoes and Couplers have been continued; also, the committees on Draft Gear, Side Bearings and Center Plates, Cast-Iron Wheels, Outside Dimensions of Box Cars and Pipe Unions. New committees have been named on Steam and Air Line Connections, Collarless Journals, Signal Lamp Brackets and Sockets, Car Lighting, and Standard Requirements for High-Speed Foundation Brake Gear for Passenger Service.

The Vanderbilt Bolsters and Brake-Beams.

Patents have recently been issued to Cornelius Vanderbilt for the designs of bolsters and brake-beams here illustrated. The standard brake-beam shown in Fig. 1 is made of 5 in. I-beam. The brake-shoe heads and brake-beam fulcrum are each riveted to the I-beam with one ½

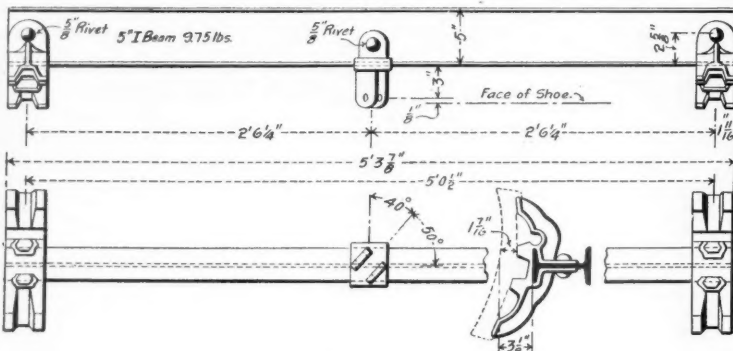


Fig. 1.

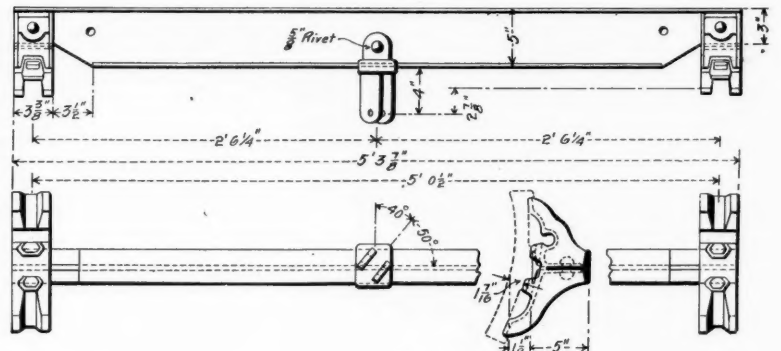


Fig. 2.

Vanderbilt Brake Beams.

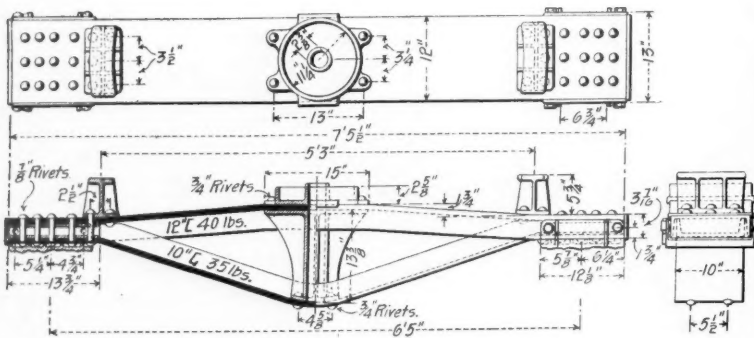


Fig. 3.

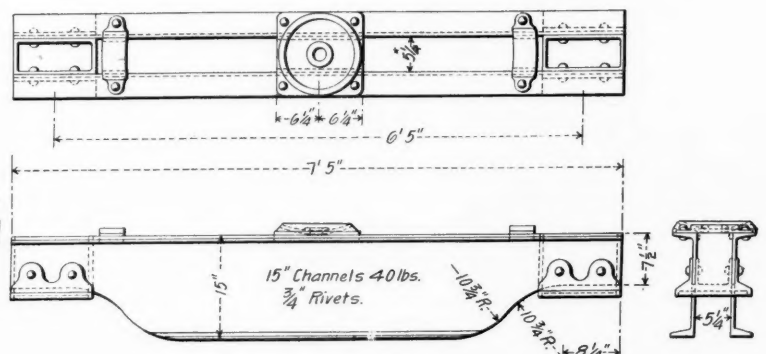


Fig. 4.

Vanderbilt Truck Bolsters.

This proposed change met with considerable opposition from the eastern members and was finally laid on the table. To make it clear what effect this rule, where it is in operation, has on the movement of traffic in the West, it is suggested that a discussion of it would be in order at this time.

A new feature introduced in the rules of interchange this year, and on which there seems to be some misunderstanding, is the key to the schedule of prices allowed for labor for repairs of air-brakes. Both of these items are shown in Rule 109. It has been assumed by some parties that the prices in the key and in the schedule of prices are for doing the same work, while, in fact, the prices in the key are for single operations which are to be used in making the schedule of prices, which includes all the operations under a given heading.

The per diem rules recently adopted by the American Railway Association and their effect on foreign cars unfit for service and undergoing repairs, was provocative of a great deal of discussion. This led to the matter being referred to the Arbitration Committee to take up with a similar committee of the American Railway Association to get its interpretation of the rules on certain hypothetical cases. If there are any cases of repairs not now covered by the interpretations given by the Arbitration Committee, a statement of these at the present time would be apropos.

Another point raised was whether the effort to hurry home foreign cars would not cause neglect in making minor repairs and result in cars being kept in poor condition. This had reference more particularly to safety attachments, such as handholds, steps, ladders, brakes, etc.

breakage and (4) the track circumstances as far as the grade is concerned; that is, whether the breakage occurred on a grade or near the terminus of a grade of given length. This information will be needed by the committee next year, to assist it in the preparation of its report. It is hoped that those of our members who have to do with car wheels, if they have not already done so, will shape their records so that this information will be available when called for by the committee.

The American Railway Association having decided upon the inside dimensions of the standard box car as 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, it asked the Master Car Builders' Association to determine upon the outside dimensions of a car of the above given inside measurements. The committee to which this subject was assigned submitted designs of framing which it believed to be substantial, capable of carrying the loads required, and be between the limitations prescribed by the American Railway Association for inside dimensions and the leading clearances of the principal trunk lines for outside dimensions. These dimensions, however, were not adopted, but the committee was continued with instructions to report next year on a system of framing above the floor for box cars.

The committee on splicing passenger car sills presented various forms of splicing now in use, and recommended the adoption as a recommended practice of two forms, one known as the Pullman standard, a practice most generally followed for splicing intermediate and side sills, the other the step splice, which was recommended for splicing all sills. The result of letter ballot on this subject indicated that neither form was satisfactory and both were therefore rejected.

in. rivet, but they are so made as to fit snugly the flange and web of the beam, relieving the rivets of stress. The special beam for inside hung brakes, Fig. 2, is similar to Fig. 1, except that the flange of the I-beam has been cut away inside of the brake-shoe head to clear the truck columns and also to permit the removal of the fulcrum casting without removing either brake head. The strength of the beam is not sacrificed because the remaining section is more than enough to resist the shear, which is the only force acting at the ends. These beams with 5 in. depth are amply strong for brake gear on 100,000-lb. cars or cars of less capacity, but when designed for use with the high speed brake the section is increased to 6 in.

The two bolsters shown differ essentially. Fig. 3 shows a type designed for 100,000-lb. trucks. It is made up of two channels riveted over the spring caps at the ends and separated at the center by a cast strut, forming a substantial truss. The top channel is 12 in. and the bottom member 10 in., which gives ample strength. They are securely fastened at the ends with 12 ½ in. rivets, and the center plate and side bearings are riveted through the top channel. The design shown in Fig. 4 consists of two 15 in. channels, separated by the spring cap castings at the ends and tied in the center by the center plate, which is riveted through the flanges. At the ends the channels are cut away to a depth of 7 ½ in., the object being to reduce the distance from floor of car to top of springs. All of the designs are simple in construction and permit of repairs being easily made when necessary.

The Buffalo Brake-Beam Co., 100 Broadway, New York, has been formed to make and sell the Vanderbilt and other brake-beams.

The History of the Walschaert Valve-Gear.

In a recent issue of the *Revue de Mécanique* M. J. Bulvin gives an account of the life and work of Egide Walschaert, who died on Feb. 18, 1901, at Saint Gilles, near Brussels, at the age of 81. His reputation, great as it was, was hardly commensurate with his merits, which were concealed beneath his modesty. It may be useful to define the circumstances under which he brought forth his great invention.

This mechanism, throughout the greater part of Europe, has been erroneously attributed to M. Hensinger von Waldegg. An error long conceived has great vitality, and although the truth was firmly established in 1875 by a correspondence between M. Urban, a director of the Grand Central Railroad of Belgium, and Herr Dwelshauvers-Dery, it is far from being universally known. To call attention to it anew is the purpose of the present article.

Walschaert was born at Malines, Jan. 21, 1820. He early showed great mechanical ability, and in 1842 was admitted to the shops of the State Railroads at Malines, as a machinist. He became the head of the shop at South Brussels at the end of two years. Al-

The drawing attached to the description of the Belgian patent is reproduced herewith in Fig. 1. In this primitive arrangement, the link, oscillated upon a fixed shaft, and was symmetrical on both sides of the shaft, but had an enlarged chamber at the center, so that only the ends could work without a great amount of play in the link-block. The link-block was reduced to a pin at the point of engagement. The single eccentric rod ended in a tee, leaving two pivotal points. The lifting shaft regulated the position of the eccentric rod and maintained it at the necessary height to engage the lower pin in the corresponding part of the link, or to put upper pin in contact and thus reverse the motion. The angle of oscillation of the link varied according to the position of the pin, and this oscillation was transmitted by a rod to the advance lever that was driven from the cross-head.

In this arrangement the central portion of the link could not be utilized in the distribution, since it was enlarged to allow of the movement of the pin that was out of gear. It may be asked why the inventor used two pins mounted upon a single cross-piece at the end of the eccentric rod, instead of a single one located on the center line of the bar, and which could be used for running

rolling stock. We owe to him a differential throttle valve, in which the preliminary opening of a small valve facilitates the movement of the principal one. It is strange that his progressive spirit survived so long in the administration of routine work. Possibly he found his inspiration in the adoption of a large number of his ideas by the Grand Central Railway of Belgium, and in encouragement which, while they did not bring him riches, prevented his mind from becoming dormant. During these years, his attention was given to elaborating the motive power to suit the conditions near Charleroi and the immense traffic that was hauled over the hilly lines.

The type of locomotive built in 1862, for work on the heavy grades of the Grand Central Railway was due entirely to Walschaert. The company had more than a hundred locomotives built on the original plans, without making any material alteration.

The appearance of the Corliss engine and the revolution which it wrought in stationary engine practice, could not remain a matter of indifference to a mechanic so well endowed. His last creative work, in 1874, was a four-valve engine having two balanced valves for admission, and two flat grid-iron valves for the exhaust. The admission was controlled by a governor that reminds one of the Sulzer engines. The exhaust valves were placed beneath the cylinder and were driven simultaneously by a contact shoe attached to the crosshead, the curve of which was traced so as to cause no shock to the valve gearing. The opening of the exhaust at one end of the cylinder coincided with its closing at the other end; so that the pre-exhaust and the compression coincided on the two sides of the piston. Walschaert established a shop at Brussels to build this engine. It was managed by his son, since his duties to the State Railroad, which he continued to fulfill up to the date of his retirement in 1885, prevented him from taking any active part in commercial affairs. This shop became a successful enterprise.

For the Walschaert engine the jury of the International Exposition of Paris in 1878 awarded him a gold medal, and the jury of the Antwerp Exposition of 1885 gave him a diploma of honor. These awards did not exceed the real merit of the engine itself, but the juries addressed them to the inventor of the method of steam distribution of 1855, and to the acknowledged master of the school of Belgian locomotives, rather than to the builder of the excellent machine exhibited.

The High-Speed Brake.

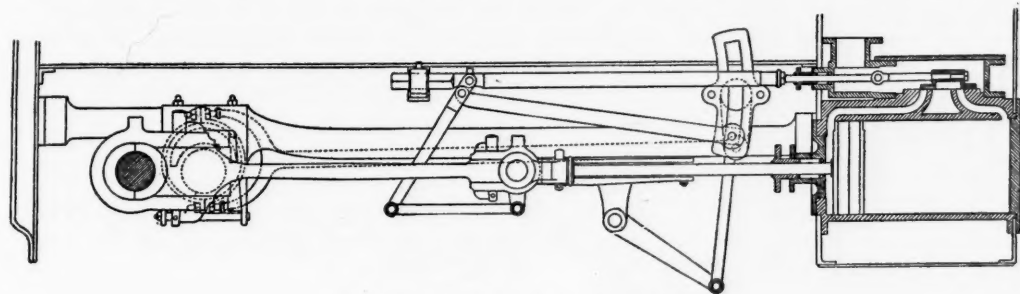
In our issue of Sept. 12 we gave an abstract of a report by Mr. F. M. Nellis on the above subject presented before the Central Railway Club. The report elicited considerable discussion and we give below a few extracts.

In answer to a question concerning the adaptability of the high-speed brake to all passenger trains Mr. Nellis said:

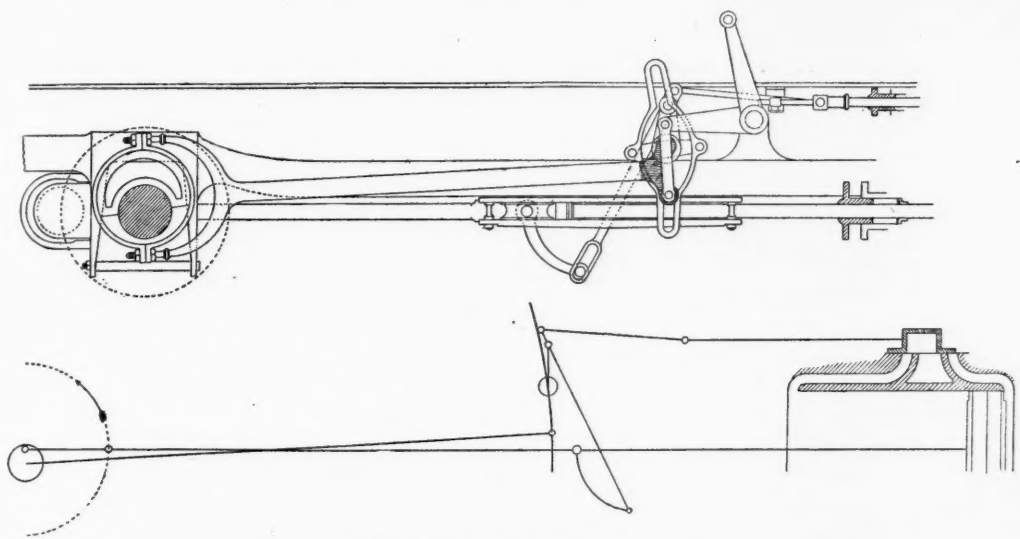
"My opinion is that the high-speed brake is certainly adaptable to suburban service as well as high-speed, long-distance train service, and that it will bring equally advantageous results to both. Since the May meeting of this club, two of the leading railroads of this country, and, in fact, of the world, have adopted the high-speed brake for all of their passenger engines and cars in both long-distance, high-speed trains and suburban service. Those roads are the New York Central and the Pennsylvania systems. The Lehigh Valley Railroad has even gone further, and at this moment has the high-speed brake equipment on nearly every passenger equipment car. That road will probably be the first road in the world to have their entire passenger equipment fitted with high-speed brakes. The equipment of their locomotives with high-speed brakes is going forward as rapidly as are the cars.

"Viewed from a point of greatest possible safety to the traveling public, I cannot see why the high-speed brake is not equally as good for suburban trains as it is for high-speed, long-distance trains; for the public is certainly entitled to just as much protection in one case as in the other. There are frequently times in modern service when the suburban trains have to run just as fast as do the long-distance, no-stop trains; in fact, their speed between stations is oftentimes higher than that of the long-distance trains. These suburban trains, being exclusively passenger carrying trains, should by rights be supplied with even greater protection than the usual long-distance, high-speed trains which carry a large proportion of mail, express and baggage. Emergencies are just as likely to arise demanding the shortest possible stop to save human life and property with the suburban train as with the more favored long-distance, no-stop train.

"Considered from a technical or service viewpoint, the high-speed brake is even better adapted to suburban train service than to long-distance, no-stop trains for which it was primarily designed. In the latter service, the chief advantage, or rather, the superior qualities of the high-speed brake, is its ability to reduce the length of an emergency stop about one-third. The infrequency of service stops with the long-distance, no-stop train, and the distance given it in which to stop, does not bring out the full value of the service feature of the high-speed brake. In suburban train service, however, where speeds are high and stops frequent, the high-speed brake may be seen brought out in all of its superior qualities. The 30 per cent. shorter distance of an emergency stop is



Walschaert's Variable Valve Gear of 1848.



Design for Walschaert's Patent—Oct. 5, 1884.

though he was at that time but 24 years old, he had already manifested the qualities that go to make an engineer and which ought in a few years to have led him into the technical field of traction. But he remained in charge of this shop all of his life. Is it necessary to lay the blame at the door of that class feeling which would not permit of the elevation from the ranks of a man, who not having finished his studies, was deprived of the regulation diploma? He was a mechanic, rather than an executive; and he had an inborn distaste for useless work, inquiries, reports and communications.

The first locomotives were sent over from England and they had not been in service 10 years when Walschaert became chief of the shops. The railroad system of the country was being rapidly extended, the personnel of the service was being formed, and experience was being acquired. Walschaert was not only capable of meeting the requirements imposed by these difficult circumstances, but he branched out into new fields by the invention of his system of steam distribution.

On Oct. 5, 1844, M. Fischer, the engineer of the State Railroads at Brussels, made an application for a patent for Egide Walschaert for a "new system of steam distribution applicable to stationary and locomotive engines." This Belgian patent was granted by royal decree on Nov. 30, 1844, for a term of 15 years. As the administration regulations did not permit the shop foreman to exploit a Belgian patent for his own profit, there is found the reason for M. Fischer's intervention, who, however, never claimed the slightest material or moral credit for the invention.

On October 25 of the same year, Walschaert took out a French patent on the same invention. There also exists, among the documents left by the inventor, a contract signed at Brussels in 1845 by Darneulde, from which it appears that he was engaged to obtain a Prussian patent on the new system, Walschaert assigning a half interest in the profits resulting from its exploitation in that country. It is not known, however, that that contract was ever executed.

in either direction without necessitating that central opening. But it should be remarked that the eccentric rod is raised or lowered according to the position of the lifting shaft, and that this required a slight change in the angle at which it was keyed, so that, for a given length of link it was important not to exaggerate the inclinations, whereby it would be necessary to reduce the throw of the eccentric.

The mechanism described in the patent of 1844 presents, in spite of all differences, a very great analogy in principle to that which every one is familiar with, and which the inventor certainly built as early as 1848, as shown by a drawing taken from the records of the Brussels southern shops, and which contains the following memorandum: "Variable cut-off according to the system of E. Walschaert as applied to locomotive, No. 98, Brussels, Sept. 2, 1848." This drawing shows the mechanism as we now know it; for, while it is quite true that the link and the advance lever are frequently placed differently, so that the eccentric rod and valve stem are both shortened, it sometimes becomes necessary, in locomotive practice, to place them as they are shown.

The system invented by M. Heusinger von Waldegg in 1849, and which he applied in 1850-'51, only differs in minor details from the design shown. Walschaert, therefore, ante-dated him by five years, if we accept the issue of the 1844 patent as the base of calculation, and by one year if we take into consideration only the modern form of the mechanism. When Walschaert developed his invention, there was really but one system of steam distribution in extensive use; that was Sharp's, with two eccentrics fitted with forked rods. The link attributed to Stephenson had been invented by Howe in 1843, but it is doubtful if Walschaert had ever seen it. For the investigators of that time, the problem was shrouded in mystery, and admiration is due to Walschaert.

In later years all of Walschaert's energy was devoted to his duties as chief of the shop, and it is difficult to say what part he took in the development of railroad

equally advantageous and equally enjoyed by the suburban trains as by the long-distance, no-stop trains. But equally great, stands out the multiple service feature of the high-speed brake, for at least three full service applications, each of equal power and each equal to and even greater in power than the ordinary service stop, may be made without recharging the train pipe and auxiliary reservoirs. This, I hold, is certainly a great advantage, and an ideal brake feature which cannot be overestimated in the safe operation of suburban trains."

Mr. Sargent—There are other things to be considered in connection with the high-speed brake, one of which is the brake-shoe. To stop a moving train is to transform motion into heat. The stored-up energy at 80 miles an hour is four times that of the same train moving at 40 miles an hour. The time consumed in making an emergency stop is approximately in proportion to the speed, that is, the stop at 80 miles an hour is made in about twice the time as at 40 miles an hour. We therefore have four times the energy to dissipate in twice the time, and it is safe to assume that the resultant heat in the brake-shoe at the higher speed is at least twice that at the lower speed. This extra rate of heating and higher temperature must be taken into consideration, and the brake-shoe reinforced to meet the increased demand for endurance, just as extra metal and better design are necessary in the foundation brake gear.

The statement is made and proved that in stopping with emergency application of the high-speed brake, brake-shoes have been broken, and the broken shoes were practically new or but slightly worn. Very little attention has been given to the brake-shoe except to make use of harder iron, and in the light of even the limited experience with the high-speed brake, it is not assuming too much to seriously consider if the common cast-iron shoe is safe to use with the high-speed brake on the heavy trains. What are we going to do about it? We cannot abandon cast-iron. The only remedy appears to be to reinforce the cast-iron shoe so that it will not be disabled by breaking. This is being done, and the common cast-iron brake-shoe with the addition of a steel back to which the body metal is securely locked is now in use on high-speed trains, giving excellent service.

It would appear that it is not so much a question as to the relative hardness of the different shoes, as it is how they will be affected by the heat generated in the act of stopping the wheel, for as regards the mean coefficient of friction, the results indicate that at high speeds and pressures the hard shoe shows up very nearly as well as the soft. The question that will come up, however, is, what will happen to the hard shoe by reason of the terrific heat it will be subjected to in making an emergency stop? Hard iron will crack more readily than soft, because the heat will not pass through it so easily, and the expansion is less, so the heating is what we must look out for. I believe any chilled face unflanged shoe, and my company makes them all, is liable to crack in making an emergency stop with a heavy train equipped with the high-speed brake, and unless the shoe is protected against falling apart in event of cracking on the face, the shoe will be made useless.

Cost of Production Increasing.

Manufacturers of iron and steel products who do not control the supply of their raw material are finding the cost of production increasing heavily. Various causes have operated to bring about a great change in this respect from the conditions prevailing before the revival of business activity in 1898. We were then suffering from a surplus of everything entering into the production of manufactured goods. Our facilities for mining ore and coal, for making coke and for converting raw materials into finished products were much in excess of home requirements. A comparatively short time has sufficed to bring about a complete transformation. One of the striking features of the business history of the United States is that the recuperative energy of the people, following a period of depression, has never been more than faintly comprehended. The developments of the current period of reawakened energy have thus surpassed all expectations. They have demonstrated that the country's domestic requirements have so heavily expanded as to exceed present facilities in lines which it had not been thought possible to overtax. The consumption of iron and its products is so much in excess of the capacity of our blast furnaces and steel works that even if no miners' strike had diminished the supply of fuel it would have been necessary to draw upon the resources of foreign manufacturers. Transportation facilities, despite lavish expenditures for rolling stock and track improvements, have proved seriously inadequate to meet the necessities of the times and traffic is badly congested at all important commercial centers. In addition to these influences the demand for labor, especially skilled labor, has long been so heavy that it is often a matter of great difficulty to man a new factory or to push a scheme of improvements requiring the speedy organization of a considerable force of workmen. In many branches of manufacturing industry the wages of skilled workmen have been advancing beyond union scales as a result of the great demand for more help.

A continuance of high cost of production into the coming year is indicated by contracts for raw materials which are now being made. Consumers of coke are placing orders at much higher prices than those ruling on this year's contracts. Much more than half of the

output of merchant pig iron which will be turned out in the first six months of 1903 has already been sold at prices which are fully 50 per cent. above the average contract price on iron delivered in the past nine months. The coal miners' strikes have intensified the influences making for higher costs by cutting down the supply of fuel so seriously that, even if they are all speedily settled, coal of every kind will for months cost a great deal more in all Northern manufacturing localities than for many years. It will require considerable expansion in manufacturing and transportation facilities or a decided falling off in the consumption of iron and steel to reduce costs to anything like the level of 1898.—*The Iron Age*.

The Interlocking Brake-Shoe.

A brake-shoe which can practically be consumed in service, thereby eliminating the brake-shoe scrap pile, and which consequently has a longer life and gives increased mileage, and also one whose construction enables it to wear out without danger of breaking, increasing the factor of safety, commends itself to consideration in railroad economy. A shoe for which the possession of those advantages is claimed is shown in the accompanying illustrations, and is called the interlocking brake-shoe from its most prominent characteristic.

The shoe as it appears in service is shown in Fig. 1, the leading feature of difference from a similar view of an ordinary shoe being the thin piece on the face of the



Fig. 1.



Fig. 2.—Back of Interlocking Brake-Shoe.

former and the dividing line at the middle. Fig. 2 shows a back view of the shoe separate from the head. It will be seen that it is made in two parts, divided in the middle through the holding lug. The surfaces at the division of the holding lug are sloped from the back of the shoe outward, as may be seen in Fig. 1. The object of this provision is to enable the shoe to adjust itself to the tread of the wheel, as a result of the M. C. B. requirement that there shall be a space of $\frac{1}{16}$ in. between the shoe and the outer end of the brake-head. In adjusting itself to a proper bearing the ends of the shoe may retire outward until they come against the ends of the brake-head, throwing all strain on the latter.

When the interlocking shoe is first applied, what is

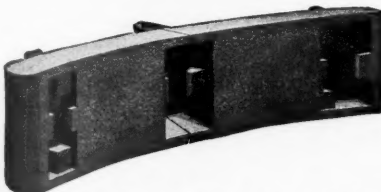


Fig. 3.—Pocket-Face of Interlocking Brake-Shoe.



Fig. 4.—Worn Out Interlocking Brake-Shoe.

called the plain-faced shoe is used. This equipment is also used for foreign equipment and for new equipment. In subsequent applications the pocket-faced shoe, shown in Fig. 3, is used, the back of one shoe fitting the face of another. When the shoe first applied is worn down to a thickness of about $\frac{1}{2}$ in. it is removed and the back inserted in the face of the pocket-faced shoe and the two applied together on the brake-head. It will be seen that by this arrangement each shoe may be worn almost entirely out; for after the body of the old shoe has disappeared the lugs remain in and fill the pockets until the retaining lugs in the latter have been worn off. All that remains of an interlocking shoe are the tips of the lugs as shown in Fig. 4. When the pocket-faced shoe in its turn is worn to the limiting thickness it is removed from the head and inserted in the face of a new shoe, and so on, indefinitely.

In addition to the advantage claimed for the divided construction which, through the ability for adjustment

that it imparts, enables the shoe to compensate to a great extent for inequalities in the adjustment of the brake-beam, it is claimed that the net saving resulting from the use of this shoe amounts to from 35 to 48 per cent. over other forms of shoes. The interlocking shoe, having four points of contact with the head, is relieved of the strain which the solid shoe suffers as a result of the clearance between its outer ends and the head, which causes the latter form to break when about half worn out. The interlocking shoe can, it is claimed, be worn down two-thirds without breaking, after which it is removed and inserted in an entirely new shoe. Furthermore, a shoe possessing the advantages just named would naturally add to the safety of operation, and the roads who have used this shoe to a great extent claim that their records prove its construction makes it the safest shoe, as these shoes do not break in service, and also that its use cuts down the brake-shoe consumption more than one-half.

These shoes may be made with or without inserts, or of a special mixture, as users demand, the same relative wearing qualities obtaining with each class. According to the makers, one of the best roads has used the interlocking shoe exclusively on its tenders, freight and passenger cars for three years keeping an accurate record of the annual consumption to compare with a similar record for the types of shoes previously used. The result has shown the above mentioned net saving and reduction in consumption.

These shoes are made by the Manufacturers' Railway Supply Co., Chicago, which has recently moved into much more commodious quarters on the second floor in the Fisher Building.

Ogden-Lucin Cut-Off—Central Pacific Ry.

Considerable progress has been made on the Ogden-Lucin cut-off across the Great Salt Lake. Track laying is now going on from Lucin eastward and from Ogden westward, something like 35 miles being completed. The end of the track on the lake section is 25 miles from Ogden and work is progressing rapidly.

Grading is being rushed at the Promontory, where five and one-quarter miles of grading is being done and at the same time grading is being completed on the section from Lucin to the west shore at Strong's Knob, while the track layers are closely following up the graders with the result that by October first the section will be completed and another material yard can be established at Strong's Knob and the lake section from that point eastward to the Promontory can be commenced.

Much has already been printed regarding this cut-off, but a repetition of the general details will be given for those who are not familiar with the work now in progress.

The present distance of the line from Lucin to Ogden is 145.5 miles. Much of this distance is made by the line running about 50 miles north before turning around the north end of the lake. The objections to this line other than its great distance are the many curves and heavy grades required in getting over Promontory and Kelton Hills. The elevation of the former summit is 4,905 ft. and of the latter 4,701, though other parts of the line, but a few miles distant, are but little above the level of the lake, which is 4,200 ft. A short line along the north side of the lake is out of the question, on account of the extreme irregularity and length of the same, as a glance at the map will show.

The projected line as surveyed and as being built, runs west from Ogden to the shores of the lake, crossing to Promontory Point on bank and trestle; then crosses that point through a heavy cut, thence across the main body of the lake to Strong's Knob on the west shore, and then to Lucin over an easy grade. The total length of the new cut-off will be 102.5 miles, a saving in distance of 43.2 miles over the present route around the north end of the lake.

The new line will have a maximum grade of 21 ft. to the mile. The line from the Promontory to Strong's Knob will be level and nearly on a tangent. The fall from Ogden to the east shore is 100 ft., and the rise from Strong's Knob to Lucin is 100 ft. in 52 miles. Both of these allow of very easy grades, the country being quite level. There will be two slight curves, and the whole section from Promontory to the Knob is only 26.3 ft. longer than the air line distance.

For so unique a location the line is practically free from those engineering obstacles which are generally found in a mountainous region, and yet it presents something new to the engineering world and the methods of construction are alone worth attention.

Work has been going on all summer, with the result that the land section from Ogden east to the shore of the lake is practically completed except two steel bridges, around which temporary tracks have been laid. On this portion of the line exclusive of the bridges mentioned there are no less than 44 openings, with masonry or pipe culverts.

The excavations for these are about 100 ft. long and average 12 ft. in width and 13 ft. deep. In the bottom piles were driven and sawed off 12 in. above the bottom of the excavation and concrete placed around and on top in courses 8 in. thick and the whole tamped to a water face. The grade is 20 ft. wide, with 3,000 ties to the mile and 33 ft. 80-lb. rails.

From the lake shore to the Promontory is a distance of eight and one-quarter miles. Of this distance the work of building out two and three-quarter miles was attended with difficulty, as the water had receded, leaving

a bed of mud which was in many places from eight to 10 feet thick under the salt crust.

To lay the construction track planks were first laid, upon which were placed sand bags of about 100 lbs., each crosswise, three layers deep; upon these sand bags caps of 12 x 12 in. by 10 ft. timbers are laid, then three stringers, 8 x 16 in. by 30 ft., upon which ties are placed and temporary track laid. This track is about eight feet south of the center stakes of the permanent track. This construction was carried for some three miles, a portion of the way through soft salt crust and soft mud, the remainder through water from one to two feet deep, under which the soft formation mentioned continued. Upon this track cars loaded with shale and gravel were run out, dumping their load to the north side on the permanent grade. There are some 300 men at work here, which force will be increased to about 700 as soon as work will permit.

It is near the end of this work that the big boat that has been christened "The Promontory" is rapidly nearing completion. This specially constructed sternwheeler will in all probability be placed in commission within the next 30 days. It is 127 ft. long, with a 22 ft. beam, and draws but 18 in. of water, and will be run by two 500 h.p. engines. When completed she will carry two fresh water tanks with a capacity of 15,000 gallons each. The upper deck will have a cabin for the accommodation of officers and guests of the road who may have occasion to visit the work. She will also carry food and water and other supplies to the temporary station on the lake.

The water used during building has mostly been hauled from Ogden. The company has now put down an artesian well in the lake about four miles from the east shore having a 10 in. pipe; another was driven about two miles from the shore inland with a 4 in. pipe. The latter is

nounced, but according to local experts it is thought that much difficulty will be found in certain portions of this line in driving piles. It is claimed by many that under the thick salt crust will be found a very hard stratum which will give much trouble.

The trestle here will be 15 ft. above the water, and will be as solid as such work can be, using 70 foot piles heavily timbered. After the trestle is in position material will be dumped in the center in the same manner as that employed on the other portion of the line. On this section there will be about 12 miles of permanent open trestle, at just what point as yet has not been made public.

Near the lake shore are the material yards, where may be found about 100,000 piles ranging in length from 24 ft. to 70 ft. There are also 24 donkey engines that will be used for pile driving as soon as they are required.

There are several things that are not quite as the contractors anticipated. It was intended that the men working in the water of the lake should wear rubber boots. Owing to the action of the salt in the water on the rubber this was abandoned, as the footwear became practically worthless. The result is that the men go into the water at all hours during the course of their work in their ordinary attire. Those who have scratches on their person have found that building a railroad across the lake is not fun.

Train Schedules According to Locomotive Power.

A German investigator, Mr. Ernst Spigatis, has published a pamphlet under the title of "Berechnung der Fahrzeiten aus den Zugkrafteften der Dampflokomotiven." His computations of the time of trains, based on the

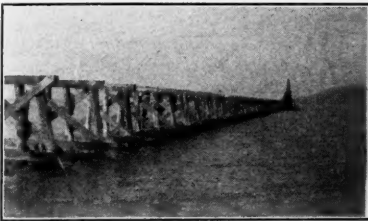
original table. The author maintains that the use of the above table is antiquated, and he attempts to deduce a method of computation which is based on the speed of the train on a level track. This speed, of course, varies with the tractive power of the locomotive and thereby the tractive power becomes a factor in the time of passage. Numerous tables are given for different locomotives and examples are worked out.

Railroad Statistics of the United States to Dec. 31, 1901.

The introduction of Poor's Manual for 1902 is just received and we shall print below a few figures taken from it. A few weeks ago (our issue of Sept. 5, page 686) we printed the statistics of the Interstate Commerce Commission to June 30, 1901, giving miles of railroad completed as 197,237, and miles worked 195,571. Poor's Manual now brings us up to the end of the calendar year and reports that on Dec. 31, 1901, the length of the railroads of the United States completed was 198,787.3 miles. The miles completed to the close of their fiscal years were 195,886.9. The reports of results of working cover 194,512.68 miles. This mileage includes, however, 2,565.96 miles of trackage. Certain figures of track, equipment, capital and results of working follow:

Railroads of the United States, Dec. 31, 1901.

Miles of railroad.....	195,886.90
Second track, sidings, etc.....	70,105.45
Total track.....	265,992.35
Locomotives.....	39,729
Cars—Passenger.....	27,144
Bag, Mail, etc.....	8,667
Freight.....	1,409,472
Total revenue cars.....	1,445,283
Capital stock.....	\$5,978,796,249



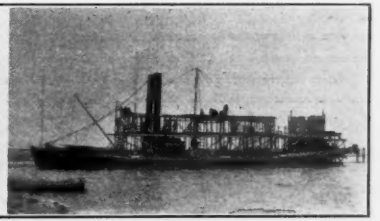
Looking West; Promontory Pt. in Distance.



Looking East; Permanent Track, Showing Sand Bag Construction.



Looking East; Filling Track.



Steamer "Promontory."

The Ogden-Lucien Cut-Off of the Central Pacific.

driven to a depth of 340 ft. The former is now discharging a good flow of water, from which pipes are being laid to carry the water to the different stations. The latter well at first gave a good flow of fresh water, but is now abandoned, as the present discharge is about one-eighth sand and wholly unfit for use.

When a depth of from four to five feet was reached in the lake the manner of construction was entirely changed. Pile driving was started at four places at intervals of about one mile. Four 40-foot piles are driven by a pile driver floated on a scow, eight pile drivers being used.

Great differences have been encountered in the nature of the bottom of the lake while driving these piles. At times a blow of the hammer did not drive the pile more than one or two inches, at other times a blow would drive it as many feet. Again many blows did not seem to have any effect whatever, the pile having struck a hard stratum, after passing through which the pile would sink as much as two or three feet at one blow. Frequently a pile after having been driven from 30 to 50 ft. would rise from a few inches to 2 or 3 ft. during the short delay of the hammer. Eventually this temporary trestle will be a rock fill.

Just before reaching the site of the permanent trestle, and at the end of work mentioned above, real difficulty was encountered—a new problem in piling. The first pile, 26 ft. long, was driven out of sight with a single blow of the hammer; the second pile, 28 ft. long, was set upon the first and one blow sent both out of sight. The formation at this point is of mud deposited here by the Bear River, which flows into the lake at this point from the north. Upon examination it was found that mud to the depth of 50 ft. had accumulated. To overcome this two 40 ft. piles were driven down, tied, capped and braced, and when the rails are laid it will hold the trains while they dump the rock fill, and in time the whole structure will become solid.

When deep water is reached, where the swift current of the Bear River forms a channel, 600 ft. of permanent trestle will be built, this being the only open trestle on that portion of the line from the east shore to the Promontory. Here is found good bottom to support the piling.

Work is being pushed east from the Promontory in the same manner, with the exception of the sand bag construction, there being a fine stretch of sand here, which offers a good foundation for the temporary track.

In the latter part of July work was started on the Promontory. This contract calls for a little more than four and a half miles of work, most of it being in a heavy cut. This as reported will take some four months to complete, and was the last contract let on the work.

The formation of the lake bottom from Promontory Point to Strong's Knob, a distance of 20 miles and a fraction, is of an entirely different nature from that encountered as above. The salt crust is not so pro-

locomotive power, fills some 70 pages, including numerous tables. It is an attempt to replace the methods used by the Prussian Railroad Department in the make-up of time-tables by methods and formulas more flexible and suitable to the conditions and requirements of present practice. The present computations of the time of a train practiced on the Prussian railroads is based on the following table.

Grade.	Coefficient for Express Trains.	Coefficient for Passenger and Freight Trains.
1:600 to 1:450	1.0	1.0
1:449 to 1:350	1.05	1.0
1:349 to 1:275	1.10	1.0
1:274 to 1:225	1.15	1.05
1:224 to 1:175	1.20	1.15
1:174 to 1:135	1.30	1.30
1:109 to 1:95	1.50	1.60
1:94 to 1:85	1.65	1.70
1:84 to 1:75	1.75	1.80
1:74 to 1:65	1.90	2.05
1:64 to 1:55	2.14	2.30

The coefficient in the above table is the number by which a given distance is multiplied to obtain the "virtual distance." The virtual distance is then the distance which the train would pass in the same time as it does the actual space, if the track was perfectly level. In other words, the decreased speed of the train on grades is expressed in increased length of line. The table is based on a formula established years ago on one of the lines. Freight trains were not considered at all in the

Bonded debt.....	6,035,469,741
Unfunded debt.....	312,225,536
Current accounts.....	456,798,012
Sinking and other funds.....	143,670,983
Total liabilities.....	\$12,926,960,521
Miles of railroad operated.....	194,974.96
Revenue train mileage:	
Passenger.....	391,543,708
Freight.....	505,468,619
Mixed.....	20,812,985
Total.....	917,825,312
Passengers carried.....	600,485,790
Passenger-miles.....	17,789,689,925
Tons freight.....	1,084,066,451
Ton-miles.....	148,959,303,492
Traffic earnings—Passenger.....	\$360,702,686
Freight.....	1,126,267,652
Miscellaneous.....	125,478,488
Total.....	\$1,612,448,826
Net earnings.....	\$20,234,727
Other receipts.....	68,368,814
Total revenue.....	\$588,663,541
Interest on bonds.....	\$215,191,176
Other interest.....	3,327,334
Dividends on stock.....	132,162,935
Miscellaneous.....	36,235,397
Rentals—Interest.....	39,127,204
Dividends.....	24,724,348
Miscellaneous.....	22,586,953
Total payments.....	\$477,355,347
Surplus.....	\$111,308,194

Extended tables of traffic statistics for 13 years are given and from them the following are condensed:

FREIGHT TRAFFIC FOR THIRTEEN YEARS.

Years.	Miles of Road in Operation.	Miles Freight Trains.	Tons *Carried.	Tons *Miles.	Freight Earnings.	Ton-Mile Rate.	Receipts Train Mile of Railroad.	Receipts Mile of Railroad.	Tons per Mile of Train Load.
1889.....	153,689	429,469,737	619	68,677	\$665,962,331	0.970	155.06	\$4,333	4,029
1890.....	157,976	482,900,422	691	79,192	734,821,733	0.927	152.17	4,651	4,376
1891.....	164,262	493,541,969	704	81,210	754,185,919	0.929	152.81	4,591	4,288
1892.....	170,607	523,831,458	730	84,413	794,526,500	0.941	151.67	4,657	4,282
1893.....	173,361	531,540,754	757	90,552	808,494,668	0.893	152.16	4,663	4,369
1894.....	176,221	475,789,885	674	82,219	700,477,409	0.864	147.22	3,975	3,829
1895.....	179,154	491,410,820	755	88,567	743,784,451	0.839	151.36	4,151	4,263
1896.....	180,891	497,248,296	773	93,885	770,424,013	0.821	154.94	4,259	4,278
1897.....	181,065	500,326,372	788	97,842	780,351,936	0.797	157.77	4,310	4,354
1898.....	184,117	542,824,509	912	114,566	868,924,526	0.758	160.09	4,719	4,959
1899.....	185,550	355,106,833	537	14,859	922,436,314	0.726	172.61	4,953	5,240
1900.....	191,455	513,667,388	1,071	141,162	1,052,835,811	0.746	204.95	5,499	5,596
1901.....	194,453	505,468,619	1,084	148,959	1,126,237,652	0.756	222.82	5,792	5,575

*000,000 omitted.

PASSENGER TRAFFIC FOR THIRTEEN YEARS.

Statement showing the length of road operated, passenger statistics, earnings, etc., etc., of all the railroads in the United States from 1889 to 1901, inclusive:

Years.	Miles Road in Oper.	Passenger Train-Miles.	Pass'ng's *Carried.	Pass. *Miles.	Passenger Earnings.	Pass. Mile Rate.	Rec. per Pass. Train Mile.	Rec. per Mile of R. R.	Pass. per Mile of R. R.
1889.....	153,689	279,085,145	494	11,964	\$259,439,231	2.169	92.96	\$1.088	3,219
1890.....	157,976	297,244,707	520	12,521	272,920,961	2.174	91.61	1.124	3,294
1891.....	164,262	320,712,013	556	13,316	294,799,696	2.184	90.67	1.170	3,385
1892.....	170,607	323,930,550	573	13,584	293,557,476	2.168	90.62	1.121	3,375
1893.....	173,361	338,551,608	597	14,979	310,442,870	2.072	91.70	1.191	3,444
1894.....	176,221	325,981,869	569	13,600	275,352,190	2.025	84.47	1.563	3,233
1895.....	179,154	326,184,596	529	12,609	260,929,741	2.069	79.99	1.456	2,957
1896.....	180,891	337,641,115	535	13,054	265,313,258	2.032	78.58	1.467	2,958
1897.....	181,065	342,464,408	504	12,494	253,557,936	2.029	74.04	1.403	2,791
1898.....	183,216	344,761,142	514	13,672	272,589,591	1.994	79.07	1.488	2,811
1899.....	185,550	355,106,833	537	14,859	297,559,712	2.002	83.79	1.604	2,809
1900.....	190,694	373,226,581	584	16,313	331,402,816	2.031	88.79	1.738	3,066
1901.....	193,823	391,543,708	600	17,789	360,702,686	2.028	92.12	1.861	3,098

*000,000 omitted.

A Typical Shop to Serve a Road or Division Equipped With 300 Locomotives.*

BY L. R. POMEROY, General Electric Co.

The items of expense entering into the cost of operation, for which the Motive Power Department is more or less responsible, represents about 30 to 35 per cent. of the total operating expenses, of which labor comprises 12½ per cent., fuel and lubrication 12.7 per cent. and repairs 8.8 per cent. These items show the very narrow field or range in which the motive power officer must confine his efforts in seeking to effect economies in his department. As the question of repairs represents nearly one-third of the items for which he is more or less accountable, the shop problem becomes quite important and worthy of careful attention.

How to best subserve his own particular conditions is the thing which the motive power officer has to consider. The factors which enter into this problem are many, but they may be gathered under the following heads:

1. Convenience of location in respect to the accommodation of the system as a whole;

the ground. There is no vibration, no danger of heavily loaded floors falling when buildings are old, nor of upper floor loads falling upon the lower in case of fire.

Perhaps it is not too much to claim that all are quite agreed that the arrangement of erecting shops with longitudinal tracks, when provided with conveniently appointed cranes, is superior to the old form of transverse track arrangement with the accompanying transfer table and the numerous doors opening thereon, even if a traveling crane is provided. Recently, however, several shops have been designed on the transverse or across track plan, dispensing with the transfer table and attendant side doors for each pit.

Plate 1 is presented to show the author's idea of the typical shop designed to comply with the conditions indicated at the head of the paper. The erecting, machine and boiler shops are practically under one roof, compact, and arranged to facilitate the handling of material, reducing to a minimum the distance to be traversed by both men and material.

The longitudinal tracks in the erecting shop side are arranged to provide 25 ft. between centers, enabling,

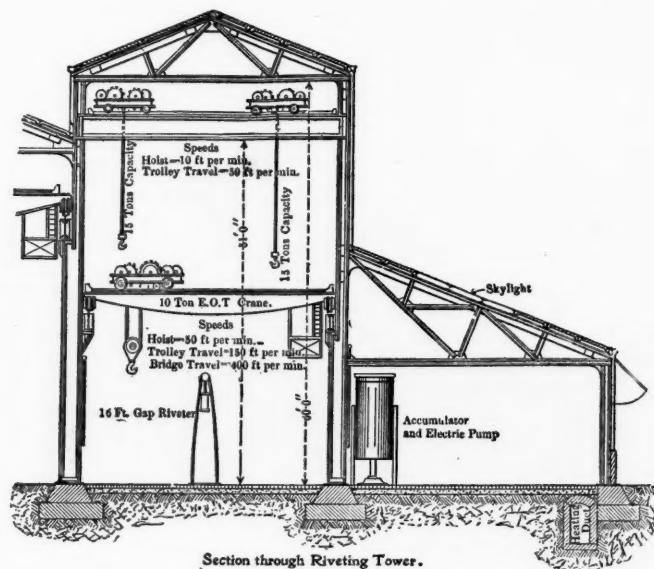
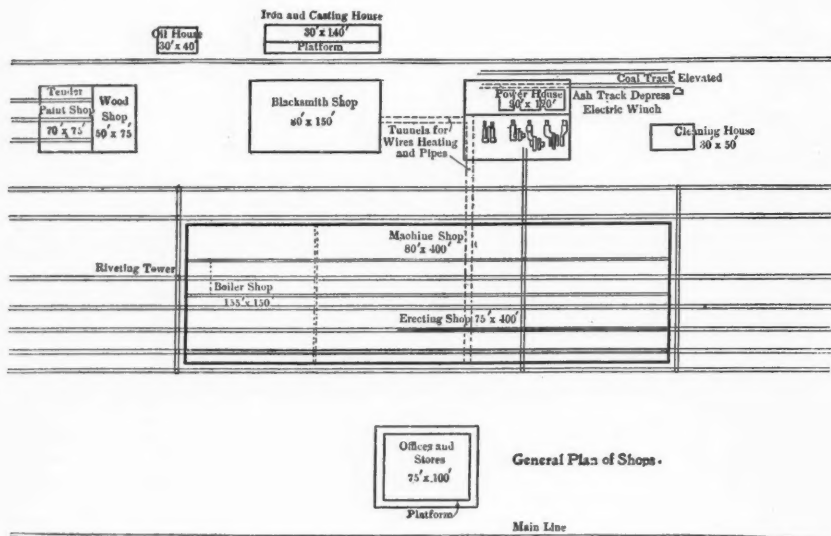
ried to any convenient or desired location. The wheels are then taken to the storage tracks provided, adjacent to the wheel and axle department, and receive attention in due course.

The machine shop side is divided into two bays; the one on the outside for the lighter tools served by light traveling air hoists locally arranged, as the tools and departments naturally determine; while in the other, nearest the erecting tracks, are grouped the heavy tools. This latter bay is provided with two cranes of 10 and 5 tons capacity, respectively. These cranes are provided with rapid hoists and serve all the tools in this bay, traversing the full length of the building and are also available in the boiler end, serving the tools of this department and running clear into the riveting tower.

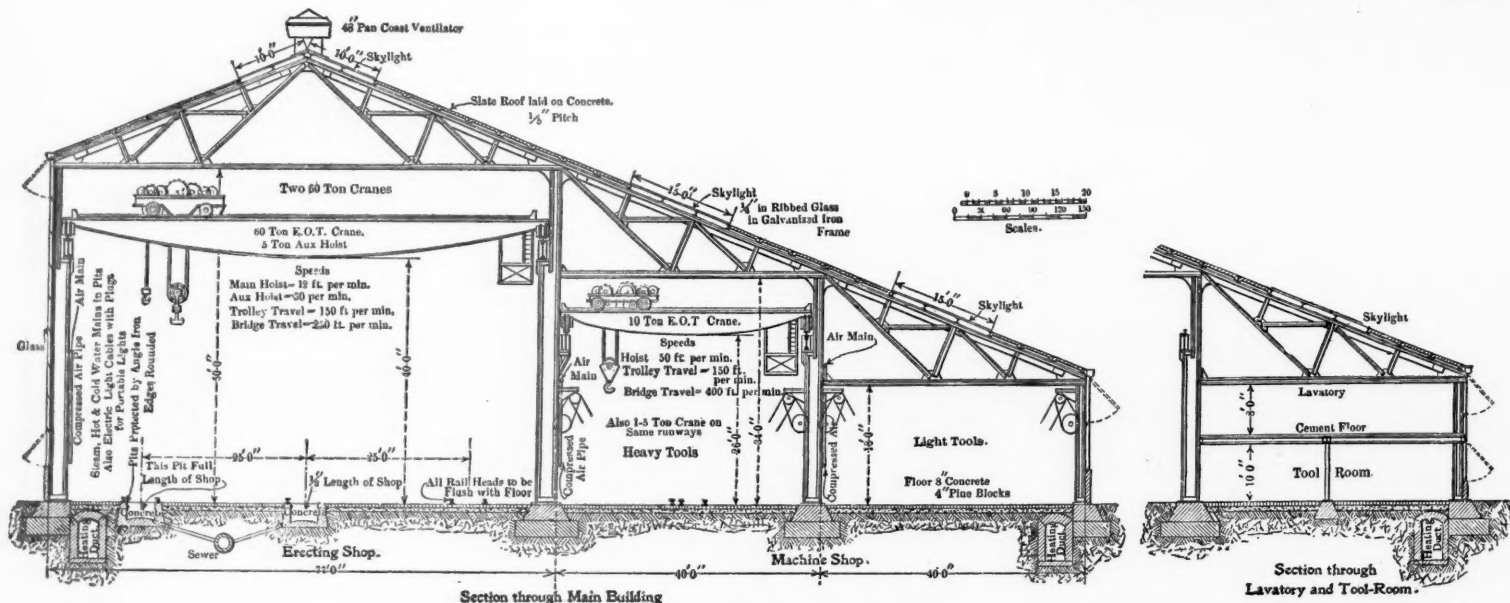
The question of tracks, both standard and industrial, should be considered and provided when necessary.

Steam and water pipes to be provided, running the entire length of the shop; also electric cables with numerous taps for portable lamps.

While no arrangement for lighting is shown on plans, yet the scheme comprehends an adequate electric lighting



Section through Riveting Tower.



Section through Main Building

Section through Lavatory and Tool-Room.

A Typical Railroad Repair Shop.

Designed for L. R. Pomero, by the Wellman-Seaver-Morgan Engineering Co., Cleveland, Ohio.

2. Convenience of location with respect to centers of supply of material and labor, and

3. Advantages of location in respect to cost of land, buildings, taxes, etc.

Shops, therefore, should be so laid out that the proper sequence of operations can be followed so as to minimize labor and lessen cost of operation. Some general considerations governing the erection and design of new shops as laid down by a Western manufacturer are pertinent in this connection and are as follows:

First. The most suitable manufacturing building is a ground-floor surface, protected from the weather and direct rays of the sun, without interfering with the light.

Second. A plant started on a scale however small should be capable of indefinite extension without expense in altering or in any way interfering with previous construction.

Third. Land enough should be secured in the first instance to avoid the future necessity of removal and abandonment of a plant at a loss, owing to lack of room.

Fourth. With land at \$2,000 per acre, or less than 5 cents per sq. ft., it is cheaper to use land for one-story buildings than to save land by building more than one story.

Fifth. It is cheapest to support machinery directly on

when necessary and desirable, the placing of engines between the tracks, thereby adding to the normal capacity of the shop; the capacity rating of the erecting shop, however, is based on the track capacity only.

As noted on plan, the erecting shop is nominally 400 ft. long, with a track capacity of 24 locomotives, allowing ample space at either end of shop and for a definite passageway between the head and rear ends of all engines standing on the tracks.

The cranes in erecting shop are in two units of 60 tons each, the combined capacity, when working in unison, enabling the handling of the heaviest type of locomotive in use at the present time.

As the cranes will not be utilized for lifting engines more than 10 to 15 per cent. of the time, two cranes are available for general use, when not employed in lifting and traversing engines, and both cranes are provided with rapid auxiliary hoists.

The boiler shop being a continuation or extension of the erecting and machine shops, one of the erecting shop cranes is available for use in the boiler department, when desired, while the other can be usefully employed in facilitating the erecting of engines, and yet both can be brought directly into service in either place, as the dictates of necessity or utility require.

The engines enter from the right, preferably by means of the center track, are lifted off their wheels and car-

ried to any convenient or desired location.

Compressed air mains to run lengthwise of the shop, and branch pipes attached to each post to run down to a point near the floor are shown. Numerous storage tanks located at convenient points should be provided to insure a steady and uniform pressure.

Tools.

The electric motor has taken its place as one of the everyday, hard-working, steady-going, reliable pieces of apparatus that is to be counted on and used with the same freedom that a pulley or a block and tackle would be applied in its appropriate place in the construction of a modern industrial plant.

Electric transmission places no restriction on the location of the machines, and each shop may be planned with a view of handling its product with least waste of labor and with greater convenience of access to the tools.

In order to insure the greatest amount of service from shop tools, a careful calibration and a predetermined rating of each is a *sine qua non*. When the tools are carefully rated, and the best commercial speeds, as to feeds and cuts, covering the range of the tool with reference to the material and product desired, definitely determined, a more uniform output from similar machines and the maximum output from all the tools is assured. A plate giving this information attached to each tool places this information before the operator, so that no

*Extracts from a paper presented at the Master Mechanics' Association Convention, Saratoga, June, 1902.

uncertainty as to which speed or cut to use to perform a given operation is possible.

Electric Equipment.

At the present state of the art, keeping in mind rational and economical conditions, also being governed by conservative, rather than radical considerations, we would advise a judicious combination of group and individual drives.

Generally speaking, tools requiring more than 5 h.p. should be provided with individual motors, although there is no hard and fast rule for this, as the location of the tool with more or less direct reference to the work performed, average running period, whether work is constant or intermittent, and how much variable speed is a factor, are the governing features.

It is the writer's practice to make a careful study of each individual case, determine the space and distance to be covered, and arrange what seems best under the circumstances.

In numerous cases the work through the shop has been studied by means of templates of the governing sizes and pieces, drawn to scale, and these, worked over the plans, keeping in mind various combinations, exceptions and alternatives, have been of great assistance in determining the best location and grouping of the tools. Such grouping and arrangement has been the basis upon which the motor selection, type of drive or the method of applying same, has been determined.

Power House.

The equipment of the power house to completely cover the scope of the foregoing plans, necessary power for tools, steam for smith shop and heating, etc., is as follows:

Two 400 h. p. and one 200 h. p. boilers, making a total of 1,000 h. p. Ordinarily the two 400 h. p. units will drive the shop and the third unit can be used as a spare.

The light or summer load can be handled by one of the 400 h. p. units.

An air compressor capable of compressing 1,000 cu. ft. of free air per minute.

One 200 kw. generator coupled directly to a 300 h. p. cross-compound engine.

One 150 kw. generator coupled directly to a 225 h. p. tandem compound engine.

One 75 kw. generator coupled directly to a 125 h. p. tandem compound engine.

This latter unit, besides taking care of the lighting, will handle sufficient power load to carry such departments as require to work overtime when the balance of the shop is shut down.

Recapitulation.

2 400 h. p. units.....	800 h. p.
1 200 h. p. units.....	200 h. p.
Total	1,000 h. p.
1 200 kw. to 300 h. p. engine.	
1 150 kw. to 225 h. p. engine.	
1 75 kw. to 125 h. p. engine.	
650 h. p.	

Ample capacity of boiler feed and fire pumps to be provided, also feed-water heaters and economizers. Power tunnels are shown leading from power house to machine and smith shop to carry all steam, water and air pipes and provision for all electric cables and feed wires.

The absolute command of draft for the generation of the required quantity of steam, utilization of heat from flue gases made by improved forms of economizers, the ease of making ample provisions for large future capacity, and the low first cost of installation, as compared with the chimney, will commend the mechanical induced draft system in the construction of the modern power plant. With mechanical draft the labor of the fireman is much reduced, a cooler fire-room possible, with steadier steam and less labor in handling fires.

[The paper has a very complete list of tools and some excellent discussion of several general matters.—EDITOR.]

DISCUSSION.

Mr. David Van Alstine (Chicago Great Western)—I cannot make a very strong criticism of Mr. Pomeroy's preferred arrangement of shop construction because I have not had any experience with that kind of a shop, but it appears to me that there is quite a heavy investment in cranes for the work to be done and for the use that can be made of them. There are two 60-ton cranes in the erecting shop that will have between them one engine a day to handle. The only busy crane in the shop will be the 10-ton crane over the heavy tools. I suppose the objection to the cross-track arrangement, without the transfer table, is that the transfer table is a bad feature in the winter and liable to fill up with snow and get out of order, and the engines cannot be taken out. I want to emphasize particularly the value of a light crane for use over the erecting shop, the light, high-speed crane, because it is very valuable as a means of stripping engines and putting the parts back on them and in handling material, and this cannot be done economically with a 60-ton crane running at 250 ft. a minute.

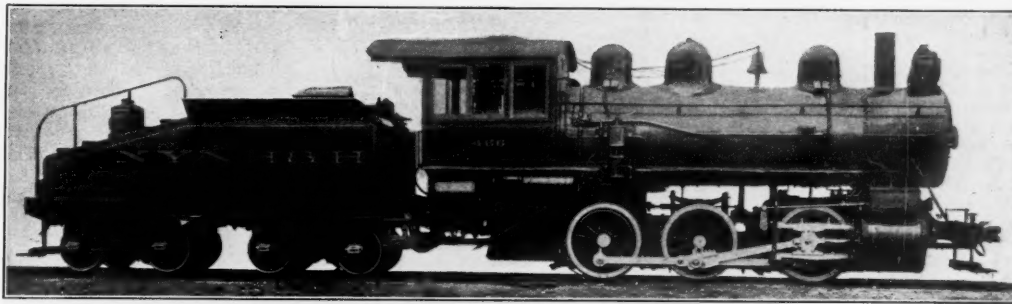
On page 8, referring to the steam and water pipes, I think it is mentioned later on that provision must be made to run the wire cables through the same tunnel with the steam and water pipes. I want to suggest that it is of vital importance that electric cables if run in the same tunnel with steam pipes, must be thoroughly insulated, and I am not sure that the insulation can be maintained then on account of the heat. On page 17, under the heading "Heating," he recites the motors required to run the fans. I want to call attention to the fact that it is considered by some that it is better to run the heating fans with steam engines, because when the motors run under light load, they run at a low efficiency, which does not make so much difference with the steam engines because the exhaust steam is thrown into the heater and used for heating the air.

The subject of "Costs" referred to on page 21, seems to me to be a subject that has not had sufficient inquiry nor enough attention, and I have felt for a long time

that we probably make our tests in keeping shop costs against the numbers of the engines. It seems to me it does not cut much figure if engine No. 50 costs more to maintain than engine No. 51. If we find there is a difference we probably will not be able to discover what caused it, but it would be of very great interest to have costs on parts of engines, and to separate under these parts the separate cost of labor and material. For instance, if we had a staybolt account and we found that the cost of maintenance of staybolts was 75 per cent. for labor and 25 per cent. for material, then we know that labor is the part of that cost that we want to reduce, and, if possible, discover if there is some better method of putting in staybolts, which we can introduce into the shop. Similarly, if we introduced a new tool for finishing driving boxes, the cost account kept against driving boxes would quickly and automatically show whether the new tool or new method had brought about the desired results. The same would apply to car work and boiler shop work, and all other classes of work.

There is one other point I overlooked in the drawing of the typical shop. As I understand it, the 10-ton crane is supposed to serve the boiler shop riveting tower. That crane will not lift the modern boiler. There are lots of boilers which weigh 50,000 lbs., and it would take a heavier crane than that to lift these boilers.

Mr. C. A. Seley (C. R. I. & P.)—Prior to three years ago I had to do with the laying out and general arrangement of several different shops in the West, and all of these were on the transverse track plan, employing a transfer table. During three years at the Roanoke shops of the Norfolk & Western I became thoroughly converted to the longitudinal track plan. Mr. Van Alstine spoke of the objections to the transfer table being from snow and ice in inclement weather. To my mind that is an important objection, but not so great as the objection to investing a large sum of money in a tool which is used a very small percentage of the time as compared with the availability of an overhead crane costing an equal



Compound Six-Wheel Switcher for the New York, New Haven & Hartford.

amount. The Roanoke shop has two cranes in the erecting shop, and one of them is available most of the time in the boiler shop. A 40-ton or a 50-ton crane with auxiliary hoist, will serve an erecting shop and do a great amount of lifting of all the details of the locomotive that need to be lifted in ordinary erection work. These cranes become such a convenience, the men get so they will hardly carry their hammers around, and I believe the investment in a transfer table nowadays for an erecting shop is not warranted.

Mr. William McIntosh (C. R. R. of N. J.)—Regarding Mr. Van Alstine's criticism of the 10-ton crane being depended upon to handle the boilers, I would say that it is not necessary that it should be used for that purpose. The boilers are handled by the large crane, and the latter should be a 40-ton crane. With reference to the transfer table, that is objectionable when we have a heavy snowstorm, but it is exceedingly useful for the balance of the time. The road I am connected with recently built quite a large shop and it was found necessary to place the transfer table to serve the passenger car repair shop and the paint shop. In looking the ground over it was found that by extending it only a little distance further, it could be placed between the machine shop and the roundhouse. In this way we have the advantage of the transfer table at a small additional expense, and so far as our experience has gone, it is very valuable.

Mr. Seley—I hope that Mr. McIntosh noticed in my remarks that I confine my criticism of the transfer table to the erecting shop.

Mr. M. N. Forney—I call your attention to the plan of shop represented by Fig. 6, page 7. This plan of shop was devised by Mr. Howard Frye, years ago, and built at Frankfort on the West Shore. As you will see, the shops are built in a position radial to the central turntable so that every shop, by putting an engine or car on the central turntable, can be served with equal facility. Quite a number of years afterwards I was called on to make the same plans for the Grant Locomotive Works which it was proposed to build in Chicago, and there was some objection to the radial plan, as there is space around between the shops. So to meet that difficulty, the upper plan on the page, Fig. 5, was devised by me, and in which you will see there is a central turntable and the shops arranged around it in rectangular groups and curved tracks are carried from the turntable to the shop. I think that plan has some decided merits in its arrangement, from the fact that it makes every shop visible from the center, it makes every one easily accessible from the turntable, and it places the office of the superintendent in a handy position.

Compound Six-Wheel Switching Engine.

The engraving shows a six-wheel, compound switching engine recently built for the New York, New Haven & Hartford by the American Locomotive Company at their Rhode Island works. The unusual feature is the use of compound cylinders for yard service. The engine is designed for heavy yard work and can exert a maximum drawbar pull of 30,700 lbs.

The high-pressure cylinder is 20½ in., and the low-pressure cylinder 31 in. in diameter; the stroke being 26 in. The boiler is designed to carry 215 lbs., and in this respect is near the highest record for boiler pressure. The weight of the engine is 135,800 lbs., all of which is on the drivers. This weight allows for an adhesive ratio of 4.4, thus insuring maximum drawbar pull regardless of the condition of the rail. The total heating surface is 1,560 sq. ft., and the grate contains 28 sq. ft. The fuel is anthracite coal or coke and the grate is of the shaking type without water tubes.

The ratio of the weight on drivers to total square feet of heating surface is 87, and in this respect it will be noted that the boiler capacity is ample for yard service. Many switchers of the simple type have a ratio as great as 100, and some of older design as high as 150. A general description follows:

Simple or compound.....Compound
Kind of fuel to be used.....Anthracite or coke
Weight on drivers.....135,800 lbs.
Weight on tender loaded.....83,200 lbs.

General Dimensions.

Wheel base, driving.....11 ft. 6 in.
Wheel base (engine and tender).....42 ft. 3½ in.
Height of stack above rails.....13 ft. 11½ in.
Heating surface, fire-box.....144 sq. ft.
Heating surface, tubes.....1,416 sq. ft.
Heating surface, total.....1,560 sq. ft.
Grate area.....28 sq. ft.

Wheels and Journals.

Drivers, number.....6
Drivers, diameter.....51 in.
Drivers, material of centers.....Main, cast steel
Journals, driving axle, size.....9 in. x 12 in.
Main crank pin, diameter.....6 in.

Cylinders.

Cylinders, diameter.....20½ in. and 31 in.
Piston, stroke.....26 in.
Piston rod, diameter.....3½ in.

Valves.

Valves, kind of.....Richardson
Valves, greatest travel.....6 in.
Valves, outside lap.....H.P., 1½ in., L.P., ¾ in.
Valves, inside clearance.....H.P., ¾ in., L.P., 1/16 in.
Valves, lead in full gear.....0 in.

Boiler.

Boiler, type of.....Straight top
Boiler, working steam pressure.....215 lbs.
Boiler, diameter of barrel.....62½ in.
Seams, kind of horizontal.....Sextuple
Seams, kind of circumferential.....Double
Thickness of crown sheets.....¾ in.
Crown sheet stayed with.....1½ in. radial stays

Fire-box.

Fire-box, length.....8 ft. 6½ in.
Fire-box, width.....3 ft. 3¼ in.
Fire-box, depth front.....61½ in.
Fire-box, depth back.....64½ in.
Grate, kind of.....Shaking

Tubes.

Tubes, number.....236
Tubes, material.....Charcoal iron
Tubes, outside diameter.....2 in.
Tubes, length over sheets.....11 ft. 6 in.

Other Parts.

Exhaust nozzle, single or double.....Single
Exhaust nozzle, diameter.....5 in., 5¼ in. and 5½ in.
Stack, diameter.....14 in.

Tender.

Tank capacity for water.....4,000 gal.
Coal capacity.....6 tons
Type of underframe.....10 in. channels
Type of truck.....Fox
Diameter of truck wheels.....33 in.
Diameter and length of axle journals.....4¼ x 8 in.

Names of Makers of Special Equipment.

Brakes.....Westinghouse and American

The Railroads of Rhodesia.

Mr. Rochfort Maguire made an interesting statement as to the present position of the railroad undertakings of Rhodesia to the shareholders of the Rhodesia Railway Trust, Limited, in London last March. The following is a summary of his chief remarks as then reported in *The Times*:

With regard to railroads under construction, there was, first of all, the line which would connect Salisbury, the capital of Rhodesia, with Bulawayo, the largest town and commercial center of Rhodesia, a distance of about 300 miles. The journey, which had now to be done by coach, and which occupied three days and three nights, would then be done in a few hours. The line was being constructed from Salisbury southward toward Bulawayo, and it passed the Globe and Phoenix Mine, in the Sebukwe district, and would serve the

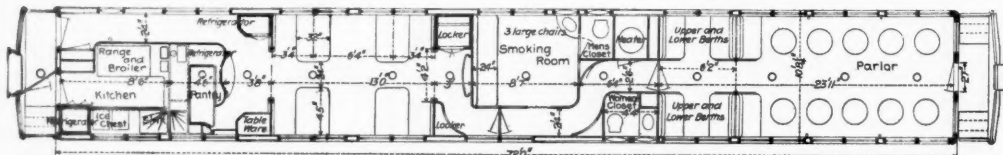
growing townships of Selukwe and Gwelo. It is expected that the line will shortly be completed to the latter place. It might interest the shareholders to know that it was originally intended to construct this railroad from Bulawayo northward toward Salisbury, and about 100 miles of earthworks and masonry were completed; but when the war broke out it became impossible to forward any construction material from the Cape ports to Bulawayo. There was nothing, however, to prevent material from coming in over the Beira and Mashonaland railroads from Beira up to Salisbury, and in order that there might be as little delay as possible in placing Bulawayo and Salisbury in railroad communication it was decided to construct the line from Salisbury southward to Bulawayo. There was little doubt that the railroad between these towns would be open for traffic before the end of this year.

The next line, the extension from Bulawayo to the Wankie coalfields, was without doubt the most important one under construction in Rhodesia, and one in which the prosperity and progress of that country was most intimately bound up. Along this line would come the bulk of the fuel for all the towns and mines in Rhodesia. The coal at Wankie had been proved to exist in practically inexhaustible quantities, and the experts who went out from Cardiff reported it to be

despatched to survey the falls and plan out the electrical installation, one of whose purposes will be to supply electrical energy for working railroad trains for a distance of say 150 miles north and south of the falls, or 300 miles in all. One ambitious idea of the Syndicate is the transmission of power from the falls for operating electric tramways, lighting, etc., in Bulawayo. This town, however, is some 240 miles distant from the falls. The chairman of the Syndicate, in addressing his shareholders the other day, informed them "that the height of the Victoria Falls was about 420 ft. and the width about one mile wide."

The Burlington Cafe Parlor Cars.

The accompanying floor plan shows the general arrangement of the new type of cars recently built by the Pullman Co. for the C. B. & Q., for use on their fast train No. 13, leaving Chicago at 9:15 every morning for Omaha. Five of these cars, which are strictly speaking a combination of parlor, dining and observation car, have been built. Their length over sills is 72 ft., width over sills 10 ft. 4 in., and width over all, 10 ft. 8 1/4



Floor Plan—Burlington Cafe Parlor Car.

only slightly inferior to the best Welsh coal, and considerably superior to any other known South African coal. The development of this area was being rapidly pushed on, and it was calculated that there would be a considerable amount of coal ready when the line reached the district, in about 18 months from the present time. The earnings of this railroad should be greatly improved from the carriage of coal alone. The railroad company had secured terms from the coal company for supplies at the pit's mouth at a little over cost price, and all lines in Rhodesia would be able to be worked very economically so far as fuel was concerned—a fact upon which the shareholders in the trust were much to be congratulated.

As soon as possible after the line had reached the Wankie coalfields, it would be pushed on a distance of about 75 miles to the Victoria Falls on the Zambesi, and thence it would be continued northward. A township would be established near the Victoria Falls. The bridge which was to span the Zambesi just below the falls had already been designed; it would be of one span 600 ft. in length, and would cross the Zambesi about 400 ft. above the water over a narrow gorge through which the river flowed at this point. The construction of the line toward the Victoria Falls was being rapidly pushed ahead, and already about 30 miles of rails had been laid and about 50 miles of earthworks completed.

It was possible also that it might be found cheaper to work the railroads for a considerable distance on either side of the Zambesi by electricity. In addition to opening up the coalfields at Wankie, this line on its way to the Victoria Falls would pass near the sandstone quarries, from the stone of which most of the buildings in Bulawayo had been constructed, and it would also pass through the immense teak forests of the Gwaii district, both of which would afford opportunities for increasing the earning powers of the line by the carriage of building material. Beyond the Zambesi the line would be taken through the headquarters of the North-Western Rhodesia administration, and further on it would tap the district in which were situated the claims of the Northern Copper Company. This copper field, which was said upon excellent authority to have very promising prospects, was situated about 150 miles northeast of the Victoria Falls, and was on the direct route which it was proposed the railroad should follow. He mentioned these various points because all development works, explorations, tradings and buildings anywhere on or near their line of railroad or beyond it would contribute materially toward the prosperity and revenue of the company. Another line now under construction was that from Bulawayo to Gwanda, which would assist the development of the mines in the Gwanda district. The line would be about 100 miles in length, and up to the present about 70 miles of earthworks had been completed. The mining industry in Rhodesia was at present in its infancy, and its rapid development depended to a great extent upon the provision of railroad facilities, and the lines would benefit to a corresponding extent by the industry which they helped to develop. The Mashonaland Railroad ran from Umtali to Salisbury, a distance of 170 miles. All the earlier difficulties in connection with this line and with the Beira line, with which it was closely associated, were disappearing. The difficulties were those which usually attended railroads in tropical climates during the rainy season.

There was now an unbroken line of the South African standard gage, 370 miles in length, from Beira on the east coast to Salisbury, the whole length of which was, by agreement with the Beira Railroads, worked by the Mashonaland Company; and as soon as the line connecting Salisbury and Bulawayo had been completed there would be an unbroken line from Cape Town to Beira, a distance of over 2,000 miles, more than half of which would be the property of the trust. The Ayrshire and Lomagunda Railroad Company were constructing a narrow-gage line from Salisbury to the Ayrshire Mine. This line would no doubt prove to be an important feeder of the Mashonaland Railroad, and it would also serve the Alaska copper district, to which arrangements were now being made for extending it. The British South Africa Company had the right of purchasing this railroad at any time, at cost; this would only be done if the traffic on the line justified it. In that case the broad gage would be substituted for the narrow, and the line taken into the Rhodesia Railroad system.

A special correspondent of the *Railroad Gazette* wrote from London two or three months ago:

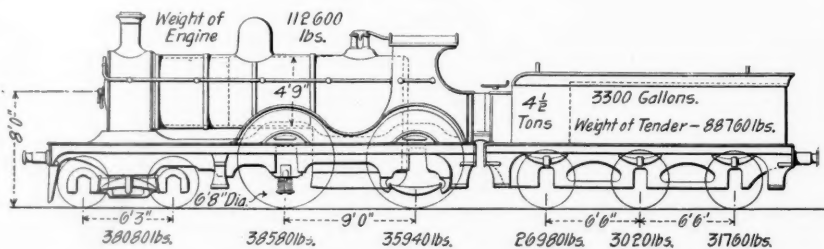
The African Concession's Syndicate, Limited, has ideas of utilizing a portion of the enormous power of the Victoria Falls for railroad working. An expedition is shortly to be

in. The interior is finished throughout in tobacco mahogany with the exception of the kitchen, which is finished in oak. The cars have full empire decks tinted gobelin green with gold decorations and Lunette deck sash. In the rear end of the car is the parlor, furnished with 10 chairs upholstered in leather. Opening off from the parlor and separated from it by large plate glass windows, is the observation platform. At the forward end of the parlor are two upper and lower berths for the accommodation of invalids. On one side of the corridor leading to the dining room is the ladies' toilet room, and on the other side the gentlemen's toilet and smoking room. The smoking room is furnished with willow chairs and leather couch. Four persons can be seated at each of the four tables in the dining room. The kitchen and pantry are large and complete and fitted with every convenience. All the openings to cupboards are fitted with sliding doors and roller curtains, thereby saving much space. The cars are lighted with Pintsch gas and heated by steam.

A British Eight-Wheeler.

Through the courtesy of Mr. Harry S. Wainwright, the Locomotive Superintendent of the South Eastern & Chatham lines, I was enabled to make a trip from Dover to London on one of his new express engines while working the boat express. This class has been working for some time and one was shown at the Glasgow exhibition of last year. The locomotives of the Chatham line were, before the building of this class, overpowered by modern loads and even at the speeds required often lost time.

The cut gives the leading dimensions, and there is one point to which I would like to draw special attention, and that is the fine way in which these engines steam; their heating surface is worth more than its nominal



New English Express Locomotive in Use On the South Eastern & Chatham Lines.

value, as is so often the case, and goes to prove the contention that per unit of power the English engine stands unrivalled.

The road is one of the heaviest in the Kingdom, the start is made out of Dover on six miles of 42 ft. to the mile, while there is a stretch of 47 ft. out of Canterbury for some miles with bad curves. The worst grade is the 5 1/2 miles up to Sole street of 52.8 ft. This is begun at a very reduced speed owing to a bad curve; from there it is mostly descending as far as Herne Hill. I give particulars of two runs. The first run was with a load of 10 coaches weighing 200 tons. The run from Dover to Herne Hill, a distance of 74.45 miles, was made in 88 minutes and 45 seconds. The second run over the same division was with a train of 10 coaches weighing 230 tons. In this case, owing to a number of stops and slows, the run was made in 102 minutes and 55 seconds.

On the second of these runs coal was inferior; though fierce burning, under the full exhaust it soon became dead when the regulator was shut. The actual work was very fine and there is no question as to the speed of these engines, while their running round the curves was characterized by great steadiness. On the grade of 47 ft.

to the mile the speed never dropped below 42 miles per hour. The engine work went far to prove that the new engines, though not very large in nominal heating surface, were so well designed as to make it worth much more than its apparent value.

R. HOPE.

Brown's Discipline in the Northwest.

The best form of discipline for enginemen and trainmen was the principal subject discussed at the September meeting of the Northwest Railway Club, which was held at Minneapolis on the evening of Tuesday, the 9th. The discussion was opened by papers presented by Messrs. S. Shepard, J. E. Goodman and O. B. Johnson. Extracts from these papers and from the remarks of others on them follow:

Mr. Shepard (*M. M. Soo Line*)—Having spent the most of my working years in engine and train service, what I have to say will be from the standpoint of an engineer. Human nature demands discipline. "Man born of woman came into this world without clothes or discipline, is prone to err and needeth a nurse of strong mind." The successful operation of any railroad is only possible so long as the force employed in carrying it on acts in harmony with the owners and managers. The careful selection of employees on a railroad is the foundation rock for the best form of discipline. Partiality shown to one employee destroys the force of discipline to all the others. Discipline should never be administered for punishment by an official who is not thoroughly conversant with all the details of the case, and he should be familiar with all practical movements of an engine or train. He should be a good judge of human nature, and avoid prejudices. Discipline should commence the very day the wiper, helper or brakeman commences work. I would open his debit and credit account on that day, I would credit him as being 21 years of age, temperate in habits, of strong build, and robust health, weight 170 lbs., education fair, can read, write, spell, compose, perform simple sums in arithmetic, is intelligent, and apparently of mild and quiet disposition. This should be the first credit for the best form of discipline. I would not employ for an engine or train man, a morose, high-tempered, fault-finding person. They cause more trouble than 25 healthy, cool headed, good natured fellows. When an employee is discharged, the books are closed; he should not be taken back in service on the same road. It destroys the effect of the best form of discipline to take back discharged employees. After the individual record has begun, I would debit all minor offenses, and credit his account with acts of good service, care being taken that the credits are not overlooked any more than the debits. He should be notified as promptly of credits received, as of debits charged. Either has its effect on the best form of discipline.

The record of each employee should be complete in every detail. I would know whether he was married or single, whether he saved his money and paid his debts or whether he squandered his earnings; whether he was lazy or ambitious; whether he was clean and tidy, or dirty and slovenish; whether he kept his engine in good condition, or depended on the roundhouse force to do his work; whether he was generally liked or disliked by other employees; whether he progressed in knowledge or stood still; whether he was a grumbler and kicker, or a cheerful worker; and it should all appear as a debit or credit.

It is necessary for the best form of discipline that the management and the men decide and agree what one run, or class of engine, has preference over another; then the men should stay on these runs and engines according to their seniority, and not be allowed to change from one run to another frequently, as their fancy desires.

Mr. Goodman.—

Conditions have so changed in train operating since Brown's Discipline was generally adopted that it is far from satisfactory. When it was introduced the rank and file were, generally speaking, pretty well contented with their lot, and those having positions were anxious to retain them. Each engine crew was assigned regular engines, and there was a friendly rivalry between the crews to see who could keep the cleanest engines, make the best record in getting over the road, and in the economical use of supplies. Crews were well satisfied, and, as a rule, they did their utmost to avoid being "Browned." When it was found necessary to administer discipline, by recording suspension marks, the efforts of the offenders to perform good service in order to have the marks removed, and a clear record again established, were certainly gratifying. The Brown system worked to perfection and was all that could be desired.

But larger engines were introduced and this meant longer and heavier trains; delays were more frequent; speed much slower, which resulted in a greater number of hours on the road. Harder service, together with long hours, accompanied in many cases by loss of sleep, tend to make men indifferent, careless, and dissatisfied, and

when in that condition, they are not so particular in observing instructions, and the penalty of a few suspension marks has little effect on them. The pooling of engines has damaged the discipline to some extent, particularly on roads where there is no system of inspection, caring for and cleaning the power. Enginemen are supposed to take as much interest in every engine they run in the pool system as if they were assigned to regular engines, but this will not operate properly in practice, and the Brown method will not bring about the desired results.

Mr. Johnson—With the "Brown" system, where only one side of the account is kept, a man has no good deeds applied on the credit side of his account. Once they get discouraged, they do not even try to recover, and the "application" on his record causes but little irritation, especially among the less sensitive, which usually constitutes the majority. By keeping the books differently, why should not the system encourage men to take more interest? Take notice of, and show appreciation for good service rendered, by letter, or otherwise.

President Van Alstyne—This subject is interesting to all operating men. There is more or less dissatisfaction with nearly all the forms of discipline that I know anything about. With the Brown system of debits and credits by record, a man is punished with a given number of marks, and through a given term of good service these marks are wiped out, and the accumulation of a sufficient number of bad marks is sufficient cause for discharging him. Then there is the simple method of keeping the personal record, in which everything that a man does, good, bad or indifferent, is recorded, and if his personal record in course of time appears to be below the average of other men with whom he is working, it is cause for reprimand or removal. There are objections to the latter method in that there are lots of men who are too hard-headed for that form of discipline to appeal to. They do not care anything about personal records;

superintendent was officially beheaded, and the cause was "Pickwick Rye."

Mr. Horton—The Brown system, as we have it on our road, seems to work very satisfactorily. It is preferable to being laid off and having your services dispensed with for 30 or 60 days. I am sorry to say that credits are not given to the men as freely as debits. It is a pretty hard matter to always find out just when the man is entitled to a credit, and I think perhaps that it rests more with such people as myself than it does with the heads of departments, for I am out on the road a great deal, and see when a man does a worthy deed, and perhaps I am at fault for not reporting it to the head of the department.

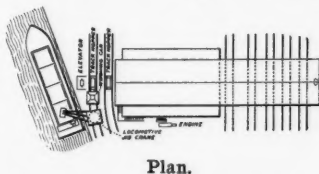
Locomotive Coaling Station for the Long Island R. R.

The accompanying cuts illustrate the coaling station recently constructed for the Long Island Railroad at Long Island City, N. Y. This station has a capacity of 3,200 tons; of which 800 tons are in the track pocket directly tributary to the engine tenders, and 2,400 tons are in auxiliary storage adjacent to the track pocket.

Coal is handled either from cars or barge by means of a conveyor and a locomotive revolving crane.

The arrangement of the machinery is shown in Fig. 1.

The elevator-conveyor encircles the track pocket, the auxiliary storage, and the two delivery tracks. The locomotive revolving crane operates on one of the delivery tracks and is equipped with a clam shell bucket which delivers coal from the barge to the hopper under this track. The auxiliary storage is tributary to the elevator-conveyor, thus allowing the coal to be de-



Plan.

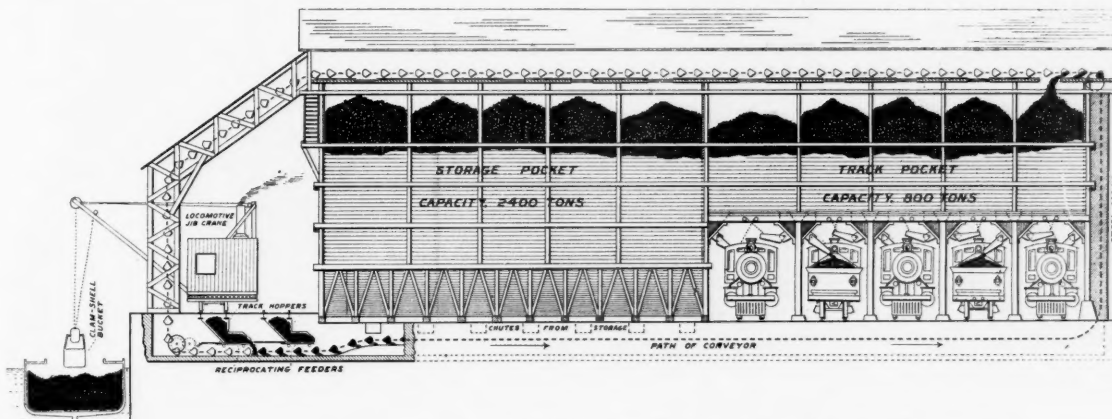


Fig. 1.—Long Island Railroad Coaling Station—Long Island City.

as long as they can work and draw their money they are satisfied.

Mr. Shepard—When we hire brakemen I think the same care in selection should be taken as with engineers or firemen. The greatest part of our trouble is due to the fact that we wait until the time is limited before we want these men. We ought to get our men picked before the rush. That seems to be the greatest trouble we have; we do not have employment for men in the dull season and during the fall business we have to get men so fast that we have to take men that are not up to the standard and consequently we lose the best form of discipline in getting these men.

Mr. Foque (Mech. Supt. Soo Line)—Since the so-called Brown system was put into effect I have been one of its ardent followers, but I must admit that there is considerable truth in what Mr. Goodman says. A few years ago we had a class of men who as a rule took a great pride in the records, and a debit meant as much to them as a suspension for 30 days. These men are probably just as anxious to-day to have a clear record, but with the advent of heavy power, the consequent delays and long hours, this element disappeared to a certain extent and was supplanted by a class who are not so particular. Any good system of discipline must have a credit as well as debit side. Some men seem to care very little how many debits they receive, provided they are not given so often that they cannot be offset by a few months of good service. Such men remain in the employ of the railroads and the better class see that in spite of their breaches of discipline the poorer men still remain in the service and hold their rights. This is more or less discouraging; but the Brown system is in my opinion still to be much preferred to the old system of suspension with consequent loss of pay and not infrequent hardships involved. Enginemen, like those in other walks of life, are susceptible to the Golden Rule, and it is my opinion that the undesirable element should be kept weeded out as far as possible, leaving a class of men to whom the Brown system is not only applicable but satisfactory.

Mr. Keim—Discipline is often too trifling. I know of a case where a superintendent walked into a round-house and saw two firemen sparring and having a jolly good time; he suspended those firemen for 30 days. He put on their records "For scuffling." Subsequently this

livered to track pocket without shoveling. The track pocket spans the five coaling tracks so that five locomotives can take coal simultaneously.

The machinery is so equipped and arranged as to insure the most economical handling and minimum breakage. Conspicuous in the equipment of the machinery is the device for uniformly feeding coal to the conveyor, and the gates under the track pocket which positively cut off the flow of coal when the tender is filled.

This station was designed, erected and equipped by the Link-Belt Engineering Company.

Railroad Freight Claims.

At the October meeting of the New York Railroad Club Mr. R. L. Calkins, Freight Claim Agent of the New York Central, presented a paper on "Railroad Freight Claims." An abstract of this paper, with some notes on the discussion, follow:

The necessity of the establishing of the freight claim office was demonstrated in the number of claims presented for adjustment with the growth of traffic, and the desirability of some one officer giving his entire time and attention to their adjustment.

Claims were classified as: First, those arising from some form of negligence on the part of carrier or carrier's servants. Second, those arising from improper preparation of freight for shipment. Third, those arising from shortage claimed after delivery of freight seemingly in perfect order, to consignee.

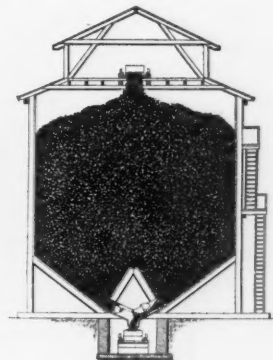
Considerable stress was laid on the possibility of reducing in large measure the number of the first class through a close co-operation of the freight claim department with the transportation and mechanical departments. In the second class, reduction in the number and value of claims it was suggested could be made through co-operation of the traffic department in requiring better protection, especially for the higher classes of merchandise to insure their safe carriage under reasonable handling. The third class of claims is far more difficult of treatment, requiring the claim agent disposing of them with equal justice to his company and to the claimants to be possessed of a judicial mind, more than ordinary ability to discriminate as between men and courage to enforce his convictions.

Considerable more could have been said on the vital importance of prompt, equitable and courteous treatment of claimants by the freight claim officer and his subordinates in helping to secure traffic for the road by its soliciting agents. Reference was made to the fact that direct losses are large in amount, but the indirect losses through impairment of reputation of the carrier by inefficient freight claim office service are impossible of calculation. Further remarks on the subject of the working of the claim department, the handling over of refused or unclaimed freight, the reduction of errors readily avoidable by the clerical station force, etc., were presented.

In the ensuing discussion much stress was laid on the value of the work of the Freight Claim Association, which was also referred to briefly in the paper, in systemizing methods of promptly handling freight claim work, and particularly of establishing more harmonious working between connecting lines. There is, however, still considerable to be accomplished in this direction. The trend of the discussion was in the direction of the "community of interest" idea, elaborated by Mr. B. D. Caldwell before the club last January, and tended to show from the different standpoints of the transportation, mechanical and traffic departments how that probably more could be accomplished in this direction than in any other.

Some Heavy Freight Trains.

During the past two years there have appeared in our columns various notes of a few very heavy freight trains. The first, of importance, was in the *Railroad Gazette*, April 26, 1901, and stated that a train of 94 cars having a total load tonnage of 2,786 tons had been hauled over the New York Central from Dewitt to Albany by the New York Central, a distance of 140 miles, in 11 hours and 20 minutes. The engine was a two-cylinder compound consolidation and belongs to the G-1 classification. These engines have 164,000 lbs. on drivers and a heating surface of 3,217 sq. ft. While the gross tonnage was not



stated it must evidently have been not far from 4,000 tons.

On May 3, 1901, a freight train consisting of 92 cars and having a gross tonnage of 4,017, was hauled over the same division by an engine of the same class as above noted.

Again, in our issue of July 18, 1902, mention was made of a train of 87 cars weighing 4,091 tons which was hauled over the above division by one of the G-2A tandem compound consolidation locomotives at an average speed of 12 miles an hour.

The longest train which we have recorded, was hauled on the Pennsylvania and New York divisions of the Lehigh Valley Railroad from Sayre to Weldon, a distance of 82.4 miles. Since publishing the notice of this run (*Railroad Gazette*, Sept. 12, 1902,) we have obtained the original train sheet and the profile of the road. The train consisted of 104 cars and weighed 4,014 tons. The run was made in 6 hours and 5 minutes, thus showing an average speed of 13.55 miles an hour, and cutting out 63 minutes for time consumed in stops, the actual running time was 16.34 miles an hour. The grades over this division are generally level or descending, the maximum ascending grade being but 4.75 ft. to the mile. The train resistance is mostly affected by the curves which are as great as 8 deg.

The engine which hauled this train is a Vauclain compound consolidation with wide fire-box. The cylinders are 17 in. and 28 in. x 30 in., and the weight on drivers is 171,000 lbs. The total heating surface is 2,973 sq. ft. While, as before noted, this train is not the heaviest we have noted, it must nevertheless offer the greatest resistance on account of its length and number of cars.

It is of particular interest to note that all of the above mentioned trains were hauled by a compound locomotive. We also find the several types of compound locomotives represented; the two-cylinder; the four-cylinder tandem; and the Vauclain.

The Michigan Lake Superior Hydraulic Power Plant.

The Consolidated Lake Superior Co. has sent out invitations for the opening of its hydraulic power plant at Sault Ste. Marie, Mich., on Oct. 25. It took four years to do this work, at a cost of \$5,000,000. The

canal is about $2\frac{1}{2}$ miles long from the intake to the overflow, and the average width is 224 ft. and the depth 22 ft. The intake has an area of more than 15,000 sq. ft., and it is estimated that the flow will be 30,000 cu. ft. per second, with a velocity of about $1\frac{1}{2}$ miles per hour. The entrance is 891 ft. wide and 18 ft. deep.

The lower end of the canal is closed in by the power house, which fronts on a large forebay. The building is of red sandstone and is over a quarter of a mile long, 100 ft. wide and 125 ft. high. The substructure consists of 81 masonry walls 100 ft. long, 20 ft. high and 3 ft. thick. The stalls or pits thus formed, aside from supporting the building, serve to deliver the water from the turbines into the river.

The penstocks are all of uniform dimensions, 40 ft. long, 15 ft. wide and 20 ft. high. The dynamos occupy space on the same floor on the river side of the power house. The energy to be developed is estimated at 40,000 actual horse power, by 320 turbines of the McCormick type placed in pairs of four in each penstock. The electrical equipment in the power house includes 80 dynamos, built by the Westinghouse Company.

Railroad Accidents for the Fiscal Year.

The Interstate Commerce Commission has issued its Accident Bulletin No. 4 for the three months ending June 30, 1902, and also presenting summaries for the year.

The number of persons killed in train accidents during

being no less than 81 per cent. The number of employees killed in coupling accidents was 433 in 1893; 282 in 1900; 198 in 1901, and 143 in 1902. The number of employees injured in coupling accidents in 1893 was 11,277; 1900, 5,229; 1901, 2,768, and in 1902, 2,113. A table is given showing the causes of personal casualties due to trains parting during the year. Fourteen trainmen were killed and 320 were injured from this class of accidents. The significant fact in this table is that two-thirds of this enormous loss of property, amounting to \$492,781, and 11 out of the 14 deaths, are chargeable to coupler failures which the railroad companies have reported as due to "cause unknown."

An Extra Heavy Driving-Wheel Lathe.

A lathe, designed to take very heavy cuts on driving wheels of from 52 in. to 68 in. diameter, has recently been built for the Altoona shops of the Pennsylvania Railroad by the Niles Tool Works Company, Hamilton, Ohio.

The lathe is driven by a 25 h.p. variable speed motor. The motor connects to the gear train by means of a magnetic clutch. The range of speeds is from 600 to 840 revolutions a minute. The magnetic clutch is double ended and is so geared to the motor that when driving through one end, the tire is turned at a speed of 10 to 30 ft. a minute. To cut out hard spots in the tire, the other end of the clutch can be quickly brought into action and the speed reduced to 4 in. to 6 in. a minute.

The right hand head-stock is adjusted by means of a

Northern could put in such low rates. The entire West reaped the benefits.

"How is it?" asked Mr. Richards, attorney for the Interstate Commerce Commission, beginning his examination, "that Union Pacific interests now hold \$80,000,000 of the stock of the Northern Securities Company?"

"That," said Mr. Hill, "is a matter that concerns them and you; not us." Mr. Hill further stated that he did not know whether the Harriman holdings were Union Pacific holdings or not, the stock having been issued to individuals.

"It would concern you if the Harriman people acquired enough more stock to control the Northern Securities Company?" asked Mr. Richardson.

"It would," said Mr. Hill.

"The only thing in the way of their controlling the majority of the stock is the fact that the shareholders cannot be found willing to sell stock?" was asked.

"I do not know that they cannot be found. The stock of any business corporation will sell at a certain figure. Of course, we have tried to make it as difficult as we could in a fair business way for a raid on the Northern Securities stock to be successful."

"As a matter of prudence would you not look to it that the stock isn't in hands that are likely to sell to a hostile interest?"

"I haven't control of the stock, but I think some owners would be very slow to sell their shares without advising with their associates."

Mr. Hill said that the increased traffic of the Great Northern was to a large measure due to the acquisition of the Burlington system. This was therefore the principal cause of the reduction of rates, because increased business gave a larger revenue which made reduction of rates possible and wise. No attempt had been made to reduce rates on the Burlington. The Great Northern had doubled its export business and increased its general business 33 per cent. He stated also that the Burlington had not been in competition with the Great Northern or Northern Pacific before it was bought. He declared that had the raid on the Northern Pacific by Union Pacific interests succeeded the Great Northern would have been so crippled that he would have advised the shareholders to sell their stock for what they could get. The Union Pacific could, he said, have cut off the Great Northern's access to many of its markets.

"You could have invoked the aid of the act to regulate commerce, could you not?"

"We have learned that this act is very unsatisfactory as it is operated," said Mr. Hill.

"You could not have stood the Union Pacific competition had it secured the Northern Pacific?"

"It's not a question of competition at all, but a question of access to markets."

Mr. Hill said that there was no agreement between shareholders of the Northern Securities Company, so far as he knew.

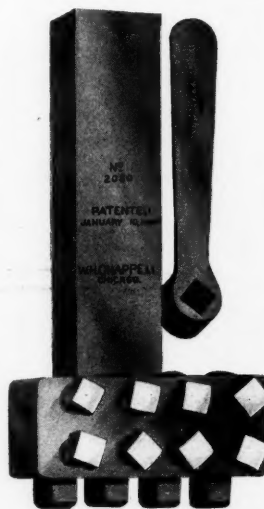
Chappell's Oblique Gang Tool.

A tool for reducing the time necessary for the roughing cuts in planing flat surfaces of iron and brass castings, the invention of W. H. Chappell, of Chicago, is shown in the accompanying engraving. The patent specification for this tool states that it "has for its object to provide a simple and efficient tool or cutter . . . in the operation of which at each stroke of the planing or shaping machine a series of independent and simultaneously successive cuts will be taken of the full depth required, the result being that a much wider surface can be planed at each stroke of the machine . . . than could be done with a single cutter of the same width of cutting edge."

Its action is described as similar to that of a gang-plow in plowing land, each cutter taking an independent cut obliquely behind the one preceding it so that one stroke of the planer with this tool equals four strokes with a single-pointed tool at $\frac{1}{16}$ in. feed.

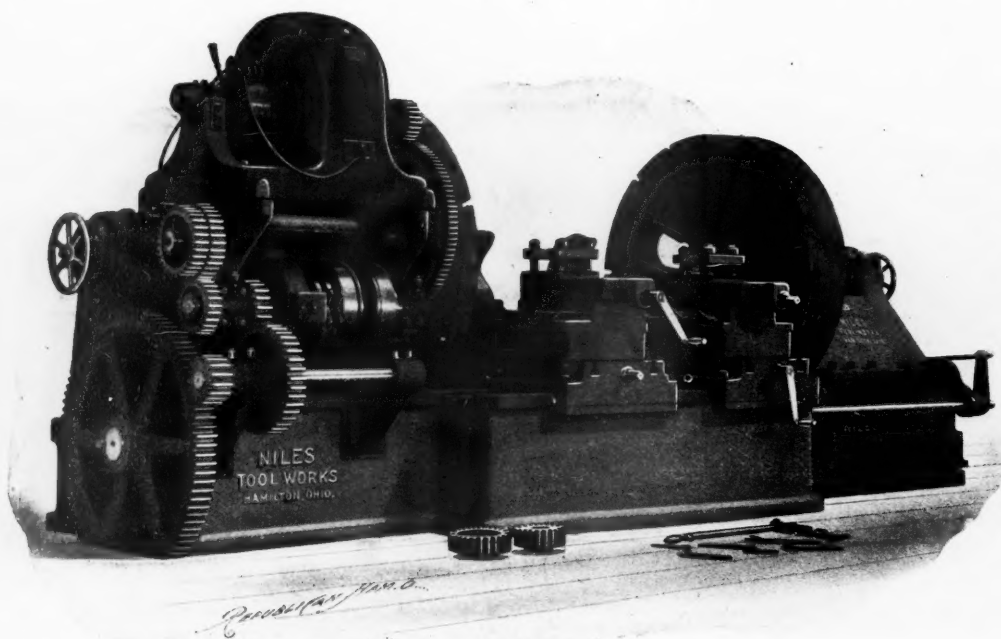
The engraving shows a front elevation of the tool, and a plan view of a piece of metal partly planed, with the points of the cutters in section and relative operative position.

In construction the shank and head of the tool are made of a single steel casting amply strong to stand the guaranteed cut, the size of the shank being $1\frac{1}{2}$ in. x 2 in. x 8 in. long.



Chappell's Oblique Gang Tool.

The cutters are made of Mushet steel and are $\frac{3}{4}$ in. x $\frac{1}{2}$ in. x $2\frac{3}{4}$ in. long. The set screws also are steel. The series of cutters is arranged each in an individual orifice in the head, each one being se-



Extra Heavy Driving-Wheel Lathe.

the months of April, May and June, 1902, was 140; and the number injured was 1,810. Accidents of other kinds bring the total number of casualties up to 10,136 (616 killed and 9,520 injured). The number of passengers reported killed in collisions and derailments shows a gratifying decrease as compared with the records given in the first, second and third bulletins. The number of employees killed in train accidents is also much smaller than in either of the three quarters preceding.

The total number of collisions and derailments was 2,010, and the damage to cars, engines and roadway by these accidents amounted to \$1,813,833. The bulletin gives a list of the worst collisions (all classes), with their causes, the term "worst" meaning all costing \$5,000 or over. The number of such cases is 26, including, however, six involving losses of less than \$5,000 each. Some of the explanations of causes given by the railroads are inadequate. In two cases, both on very prominent railroads, the conductor and engineman are reported as having deliberately "taken chances." Accidents in which the responsibility rests on men of very limited experience again appear among these costly cases, and there is one case in which an engineman had been on duty 22 hours.

The causes of coupling accidents are given in a classified table. Of the 552 persons represented in this table as killed or injured, 37 are reported as having had less than one year's experience. Of the 7,589 persons killed or injured in accidents of all kinds except train accidents, 276 had had less than one year's experience.

Yearly Tables.—From these it appears that 303 passengers were killed and 6,089 injured during the year; that 1,507 trainmen were killed and 19,902 were injured, and that the total number of employees killed was 2,516, and the total number injured 33,711. A comparison is given showing the remarkable and gratifying results of the Safety Appliance Act of 1893, which requires the use of automatic couplers and which went into full effect on Aug. 1, 1900. The number of employees killed in coupling shows a diminution of 68 per cent., and this notwithstanding the fact that there is now engaged in this work a much larger number of men than in 1893. The diminution in the number injured is still greater,

3 horse-power motor mounted at the end of the bed. The face plates are 72 in. in diameter and are fitted with internal cut gears of gun-iron. The main spindles are of close grained gun-iron—the front bearings being 13 in. x 16 in. and the rear bearings 10 in. x 14 in. The internal sliding spindles carrying the centers are steel forgings, 7 in. in diameter. All the shafts, from the motor to the face plates, run in bronze bearings and all the gearing has cut teeth.

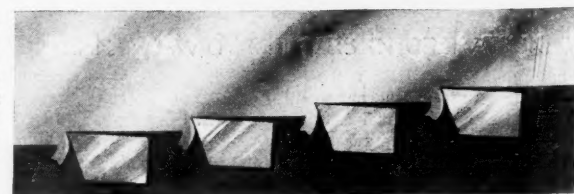
The gearing and shafts are designed to transmit a pressure of 18,000 lbs. to each tool. The gross weight of the machine is 80,000 lbs.

Mr. Hill as a Witness.

On the 21st, at St. Paul, Mr. J. J. Hill occupied the witness stand in the suit of the United States against the Northern Securities Company. The first point he made was that there had been no curtailment of competition between the Great Northern and Northern Pacific roads. The second was that when the Northern Securities scheme was launched, and while it was being matured, the smallest stockholder had an equal opportunity with the largest. A third point, and one on which Mr. Hill laid stress, was that he formed the Northern Securities Company and bought the Burlington in order to head off calamity to the Northwest. He declared that the Union Pacific had planned the destruction of the growing industries of this section of the country.

"Therefore," said Mr. Hill, "we wanted to put the stock of the two companies where it could not be raided. We wanted to place these stocks with a company which was not a railroad company and where raiders could not get at it. We believed that the larger the capital given this holding company the more secure from raid would be the stocks. We wanted to prevent another war like that started by the so-called Union Pacific interests."

Mr. Hill declared that the average freight rates on the Great Northern were far lower than the average rates on the other transcontinental systems. In fact, he said, if the Great Northern should charge the rates applied by the Atchafalpa or the Union Pacific its revenue would be increased five and a half to six millions annually. This increase was based on Great Northern tonnage and Atchafalpa rates. It was because of the return traffic that the Great



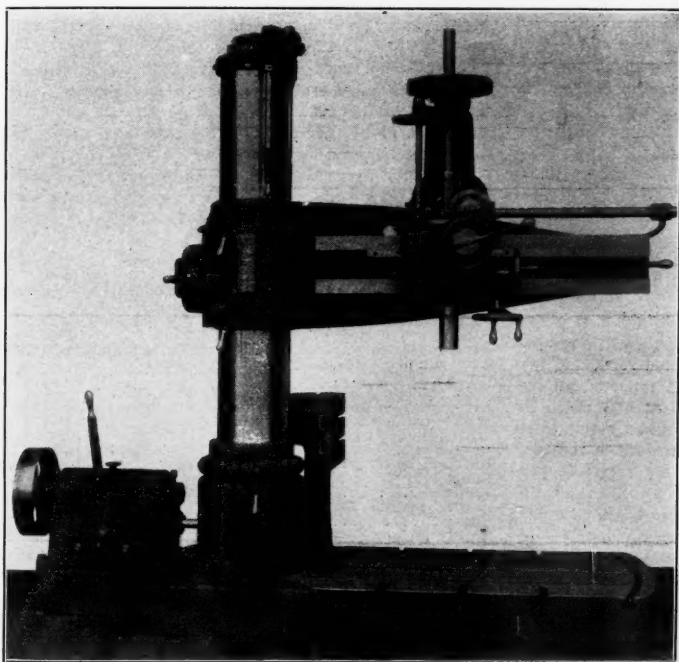
cured by a set screw. In setting the cutters it is only necessary to set them so that the points are in line on a horizontal plane by dropping the ends on a parallel strip. Ordinarily the rough surface of the casting to be planed will answer the purpose.

It is claimed that the tool will take a roughing cut over 14 sq. ft. of surface an hour and it is guaranteed to stand a cut on cast-iron or brass $\frac{1}{4}$ in. deep with $\frac{1}{4}$ in. feed. It is further claimed that it will save more than twice the money per hour paid the machinist using it when compared with the action of a single-pointed tool. If extra sets of cutters are kept on hand in the tool room, sharp and ready for use, the only delay the planer hand need experience is the time required to exchange a dull set for a sharp set.

The Edward Smith Company, Detroit, Mich., are the selling agents for the tool.

Two New Bickford Tools.

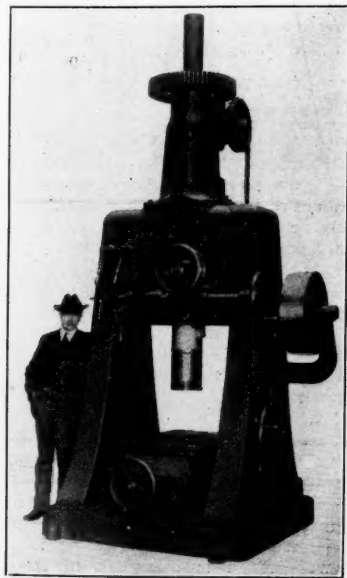
The Bickford Drill & Tool Co., of Cincinnati, has recently built for the Altoona shops of the Pennsylvania a trepanning machine, the accompanying illustration of which is made from a photograph of the tool. In general it is designed for the heaviest kind of drilling, boring, facing, topping and trepanning; the service for which this particular machine will be used will be trepanning side rods, the holes in which range from $4\frac{1}{2}$ to 10 $\frac{1}{2}$ in. in diameter. The work is first opened up with a $1\frac{1}{4}$ -in. drill and then trepanned to size. The makers say that when used solely as a drilling machine the tool is capable



Improved Plain Radial Drill.

of turning out from three to five times as much as a heavy upright drill, but in boring its efficiency is from five to ten times as great.

The head and cross rail is made in one piece, so designed as to eliminate all overhang of spindle. The table



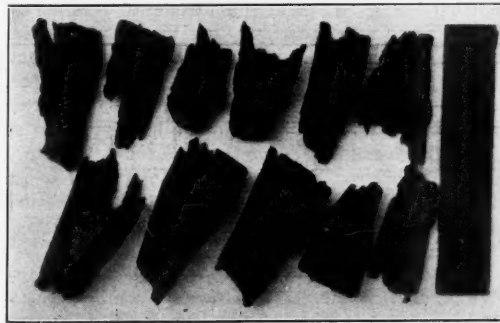
Bickford Trepanning Machine.

is adjustable both transversely and longitudinally, and may be slid back out of the way when not needed, for which purpose an extension is cast on the base. The base is also provided with an oil channel and reservoir.

The spindle has 16 changes of speed, ranging in geometrical progression from 6 to 60 revolutions per minute, each of which is instantly available without having to shift a belt, and is provided with both hand and power

feed and quick advance and return. The feeds, ranging in geometrical progression from .01 in. to 1 in. per revolution, are eight in number, and each of them is obtainable by the mere turning of a lever.

The driving mechanism is located on the back of the head, from whence levers project to the front of the machine, and, by being made to receive its power from a constant speed pulley, gives the greatest attainable econ-



Chips made with a 4 in. flat drill operating in solid metal at the rate of $1\frac{1}{4}$ in. per minute. Material, .45 carbon steel. Depth, $4\frac{1}{2}$ in. Speed, 17.68 rev. per min. Feed, .072 in. per rev. Lubricant, water. Total time, 3.65 min.

omy of power. To obtain any one of the 16 speeds with which the machine is provided, the operator has but to throw the levers one way or the other. The proper position of the levers to give the correct speed for different metals and diameters of tools is shown by a table attached to the head.

Some of the general dimensions of the tool are: Diameter of spindle, least section, 6 in.; traverse of spindle, 3 ft.; maximum distance under spindle over base, 4 ft.; distance between housings, 3 ft.; distance from floor to highest point of machine, 14 ft.; floor space required, 6 ft. x 5 ft.; weight net, 18,300 lbs.

Another interesting new tool made by this company is its improved plain radial drill, an illustration of which is shown. The features of especial advantage claimed for this machine are a much larger number of speeds and feeds, with much faster feeds than are customary. In order to accomplish this result the design embraces certain departures from previous general practice in such designs. In order to resist the combined stresses of twisting and bending the arm is made of pipe section in accordance with the well-known principle of mechanics

that a tube is the best form to resist torsional stresses. This arm may be raised or lowered by power, and provision is made to avoid possibility of its being raised or lowered through accident. The machine is provided with a safety stop that throws out the feed when the spindle has reached the limit of movement. The back gears are fitted with friction clutches which are designed to act instantly without noise or shock. By this arrangement four changes of speed are possible, each of which transmits to the spindle more than double the pulling power of the next faster one. Also the gears may be engaged or disengaged while the machine is running, avoiding loss of time by stopping to change the gears.

A depth gage is provided which enables the operator to read all depths from zero. This is a very desirable feature when tapping to a fixed depth, say, or any operation where the depth of hole is desired and is usually obtained by the use of a scale or calipers. The feeds, which operate through a friction, are eight in number and are in geometrical progression ranging from .007 in. to .064 in. per revolution of spindle.

The speed box, with its single controlling lever and driving pulley, is seen mounted on the base at the left of the column. By driving the machine from below the arm can be revolved in a full circle about the column. The driving mechanism consists essentially of a pulley, four pairs of gears, two friction clutches and an operating lever. The advantages of such an arrangement have already been referred to.

As an indication of the remarkable work which this tool will accomplish we show herewith an engraving from a photograph of some chips made with a 4-in. flat drill operating in solid metal at the rate of $1\frac{1}{4}$ in. per minute, the material being .45 carbon steel. The depth was $4\frac{1}{2}$ in., the speed 17.68 r.p.m., with a feed of .072 in. per revolution. Water was the lubricant used and the total time of drilling was 3.65 minutes.

A new four-cylinder single-expansion engine has been turned out of the Doncaster shops of the Great Northern, and it is said to have the cylinders 15 in. diameter x 20 in. stroke. This, if true, is a somewhat remarkable step since the usual stroke on that line is not less than 26. It is in-

teresting that the two newest English engines should one have 20 in. and the other 30 in. stroke, both being for express work. The new Great Northern engine is unique as there is no other "Atlantic" non-compound four-cylinder engine in the world.

The Steam Turbine—Its Commercial Aspect.*

In this country the steam turbine is now operating in several plants. The first prominent installation was at the Westinghouse Air-Brake Company's works, at Wilmerding, Pa., where the first unit was started in August, 1899. Thus, the plant has been in service, for the most part, more than three years, and the fourth unit about 18 months. The plant operates regularly 11 hours per day, the service being electric power and lighting. With the iron foundry running at night, one turbine is run 22 to 23 hours per day. In general, the units have run quite to their rated capacity—perhaps within 20 per cent. of it, as a minimum. An interesting comparison has been made elsewhere of the efficiency of this turbine plant with the installation it supplanted, the latter comprising simple and compound engines, scattered about the works. After the three turbine units had been placed in operation, they were shut down and the steam engines previously in use (not yet disconnected from service) were again started up and a test made. A test was then made of the turbine plant. These were based upon a week's run, careful measurements being taken of fuel and water. The saving of coal in favor of the turbine plant averaged 35.7 per cent. during the day, and 36.4 per cent. during the night. The saving in feed water averaged 29.8 per cent. during the day and 41.4 per cent. during the night. In round numbers, this meant a saving of about 40,000 lbs. of coal per 24 hours. This improvement, of course, was attributable not entirely to the turbine itself, but also to the more efficient method of electric power transmission in comparison with the previous scattered arrangement of steam engines, with long runs of steam piping, use of belts, etc. It is, however, instructive as indicating the results accomplished in a specific and prominent case, as between an old and still commonly used system of power transmission, and a modern method.

Summing up the experience had with this first installation, undertaken somewhat experimentally at the time, the net result is that the plant has operated about three years in heavy daily service; that the work has not suffered interruption, and that the plant is to-day running with sustained satisfaction and with no visible signs of wear in any of its parts.

The Yale & Towne Manufacturing Co., at Stamford, Conn., have a 400-k.w. steam turbine furnishing 240-volt, 2-phase current at 7,200 alternations. This outfit was started in operation Feb. 1, 1902. Since that time it has been in regular daily service, carrying about its rated load, operating 10 hours per day, furnishing current for electric motors and some lighting. Its mechanical operation has been most satisfactory. No quantitative tests have yet been made of steam performance, but there is general evidence of its economical operation.

The Hartford Electric Light Co., at Hartford, Conn., have a 1,500-k.w., 2-phase, 2,400-volt, 60-cycle, turbo-generator outfit, which was started in April, 1901. This is the largest turbine yet installed in this country. Put in, as it was, to relay their water power, it has not been in constant service, but has usually been required but one or two days a week. At such times, however, it has carried the full station load of some 18 or 19 hundred kilowatts. Reference will hereafter be made to its striking economy.

Before the machine was successfully in operation, one trouble that developed was with lubrication. The packing glands around the turbine shaft leaked somewhat, and the construction of the oil passages with reference to these glands enabled the oil to come into contact with the steam, impairing its lubricating quality. This was easily overcome by modifying the vents and employing glands of different construction.

One is impressed with two distinguishing features of the turbine's steam efficiency, namely, that it seems to vary but little over wide ranges of load, and, further, that the size of the unit has comparatively little bearing. It follows, then, that if good results are possible at all, they are neither restricted to the larger plants nor to the requirement of steady load.

Tests on a 400 k.w. turbine, made at the builders' works before shipment, gave a steam consumption of 14.47 lbs. at full load, and 16 lbs. at half rating, and less than 19 lbs. at one-quarter capacity.

If it is thus shown that with a unit as small as 400 k.w., we may obtain a result of 14.47 lbs. of steam per brake horse power per hour, corresponding to less than $13\frac{3}{4}$ lbs. per i.h.p., it is evident that moderate-sized plants may with the turbine be sufficiently subdivided to give the maximum flexibility of service, with insurance of relay, and yet possess an efficiency heretofore identified only with very large units. Further than this, a fluctuating load is not incompatible with high economical performance.

As the units become larger the turbine is then brought into comparison with the best steam engine practice, where it still preserves its uniform efficiency, and where its practical advantages are no less evident. In a recent instance, a result of 11.7 lbs. of steam per electrical

(Continued on page 820.)

*Abstract of a paper presented at the Detroit Convention of the American Street Railway Association, Oct., 1902, by E. H. Sniffin.



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EDITORIAL ANNOUNCEMENTS.

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The compilation of net earnings for the month of August as made by the *Chronicle* shows a falling off as compared with the year before of \$1,840,000, or 4.89 per cent. The gross earnings increased \$3,279,000 but the operating expenses increased \$5,127,000. This was for 105 railroads. Along with the heavy increase in expenditure was a diminution in certain movements, as, for instance, in the grain movement, which was considerably below that of a year ago. Then, of course, the anthracite strike has had an effect and also the bituminous strike in West Virginia, and, finally, the passenger movement is compared with the year of the Pan-American Exposition.

Superheated Steam in Locomotives.

We have lately printed (October 10) a translation from the German of an article on the use of superheated steam in locomotives. Among other things it was pointed out that better fuel and water records had been obtained in several tests, from a simple locomotive using superheated steam than from two-cylinder and four-cylinder compounds without superheating. If such results can be obtained from the superheated-steam locomotive in its present stage of experiment it is not unlikely that the more developed machine may be of great practical use. Even now it appears that many of the details of construction have been successfully carried out.

One of the most serious objections to the use of superheated steam is the difficulty of maintaining continuous and efficient lubrication in the cylinders. An inexpensive grade of mineral oil is said to give satisfaction on the German superheated steam locomotives. The German experiments have furthermore tended to show that the maintenance charges on these locomotives are not excessive. Conclusive proof of this can only be obtained, however, by very long service trials.

The compound engine and the use of superheated steam, both have as their primary object the reduction of the so-called initial cylinder condensation. Compounding accomplishes this, in part, by dividing the expansion into two or more stages, and hence decreases the total temperature range in any one cylinder. Superheated steam will accomplish the same effects by reason of the fact that its initial temperature is far above the temperature of saturated steam of the same pressure, with the result that much heat can be given up to the cylinder walls before condensation takes place.

There is one advantage in compounding which, however, can never be entirely realized in locomotive service and which makes the use of superheated steam especially commendable for this class of work. We refer to the very high rates of expansion which are possible in stationary practice by reason of the

use of the condenser. The exhaust pressure in a locomotive must always be several pounds above atmosphere in order that the blast may have sufficient energy to produce the necessary draft. Furthermore, it should be remembered that the theoretical maximum efficiency of any heat engine is a function of the temperature range through which the working fluid passes in transforming its heat energy into mechanical work. If, then, the temperature range in the cylinders of a locomotive is to be greatly increased it becomes necessary to make the increase at the other end of the diagram; in other words, superheat the steam. A rough calculation shows that with an initial pressure of 180 lbs., and a back pressure of 5 lbs., the maximum theoretical efficiency is 18 per cent. If, however, the steam be superheated to an initial temperature of 575 degrees the temperature range is increased and the theoretical efficiency rises to 33 per cent.

These arguments are only presented to show the peculiar adaptability of superheated steam to locomotives, and should not be construed as an argument for or against the compound locomotive. The fact is, added economies are undoubtedly possible by the use of superheated steam in compound locomotives, and it is not impossible that such an arrangement may be required in time if the increasing demand for locomotives of greater power continues.

Annual Reports.

Great Northern.—The report of this company for the year ended June 30 last shows an increase of \$8,294,000 in gross receipts (to a total of \$38,858,500) for all the railroad lines owned and operated by or affiliated with the Great Northern Railway Company, and including \$1,034,100 from the Northern Steamship Company. This increase in receipts is an unexampled one for any year in the previous history of the Great Northern Railway, marked as that has been by increasing prosperity, and the gain is only equaled by the increases in revenues reported by the two other companies now under the same control and management as the Great Northern Railway. The Northern Pacific in the year to June 30 last shows an increase in gross receipts of \$8,826,400, with an increase of only 80 miles in average operated road, and the Chicago, Burlington & Quincy Railroad reported an increase of \$3,743,300, with an increase of 356 miles in operated road. Perhaps the gain reported by the Burlington was as remarkable as any of the other records, because it was made despite the loss of perhaps 40 per cent. of the corn crop in the States traversed by the company's line, with consequent large losses in that and other traffic from the drought in the summer of 1900.

It is interesting to show the total miles and revenue of these three companies, all now controlled through the Northern Securities Company.

	Miles Worked.	Gross Earnings.	Work. Exp. and Taxes.	Net Earnings.
Great North'n	5,849	\$8,858,514	\$29,874,317	\$17,984,196
North. Pacific	5,750	41,387,380	22,438,304	18,949,076
Burlington	8,124	53,795,245	35,682,876	18,112,370
Total	19,723	\$134,041,139	\$78,995,497	\$55,045,642

The daily newspapers have attributed to Mr. Hill the prediction that these three railroads will earn \$150,000,000 gross in the present fiscal year.

The revenues of the Great Northern, as given above, include not only the receipts of the Northern Steamship Company, but also the accounts of about 513 miles of railroad worked by companies in which the Great Northern has a controlling or an exclusive proprietary interest, but whose accounts and operations are kept separate from the Great Northern's. In fact, there is even a further segregation of the property of the Great Northern Railway and two income accounts are presented in the report. One of these shows all the lines worked by the company or in direct connection with it, except the Spokane Falls & Northern of 203 miles. This is a total of 5,336 miles of road worked on June 30, the average operated in the year being 5,249 miles. The revenues of these companies for the last two years follow:

	1902.	1901.	Increase.
Average miles worked	5,249	5,202	47
Gross earnings	\$36,032,256	\$28,350,690	\$7,681,566
Operating expenses	17,789,164	15,843,421	2,945,743
Taxes	1,239,694	969,642	270,052
Net earn., less taxes	\$17,003,398	\$11,537,626	\$5,465,772
Miscellaneous income	2,001,624	1,583,027	418,597
Total net income	\$19,005,022	\$13,120,653	\$5,884,369

This is the system for which the company's operating and traffic statistics are reported, but about 771 miles of this is controlled by proprietary companies, etc., whose revenues are included in the income account of the Great Northern Railway Company proper only as they turn over to it interest on bonds or dividends on their stocks, most of their stocks and in some cases their bonds as well, being owned by the Great Northern Railway, for which the income account, covering 4,565 miles operated, on June 30 last, follows:

	1902.	1901.	Increase.
Freight earnings	\$21,002,637	\$15,367,999	\$5,634,638
Passenger earnings	5,690,996	3,943,927	1,747,069
Gross earnings	28,397,135	20,881,051	7,516,084
Oper. exp. and taxes	15,128,137	12,854,180	2,273,957
Net earnings	\$13,268,998	\$8,026,871	\$5,242,127
Net fixed charges, etc.	3,742,546	3,687,656	54,890
Net income	\$9,526,452	\$4,339,214	\$5,187,238
Miscellaneous income	2,816,458	4,247,219	*1,430,761

Total net income	12,342,911	8,586,433	3,756,478
Dividends	8,225,921	6,897,369	1,328,552
Betterments appropri'n	2,000,000	1,689,064	310,936
Surplus	\$2,116,990		\$2,116,990

*Decrease.

The large aggregate of miscellaneous income, as well as the heavy falling off in this item in 1902, is explained by the fact that it is mostly made up of the dividends and interest credited by the Great Northern Railway in its income account for interest and dividends on bonds and stocks of leased lines. The increase in net earnings, however, was so large that the surplus available for dividends was \$3,756,000 more than in the previous year and though dividend payments were \$1,328,000 more than in the previous year, the free surplus balance was still \$4,117,000, of which \$2,000,000 was set aside as a fund for betterments, new equipment, etc.

In 1901 there was a decrease of 23 millions or about 1 per cent. in the tons of revenue freight carried one mile, resulting from the shortage of the spring wheat harvest in 1900. But the short crop of that year was followed next year by a very heavy crop, which was moved in the past fiscal year, so that the increase in tonnage, as already indicated in the reported gain in revenues, was quite exceptional. In tons of revenue freight carried, there was an increase of 3,312,000, or over 33½ per cent., and an increase of nearly 708½ millions, or 28½ per cent., in revenue tons carried one mile, with an increase in freight earnings of \$5,785,400, or 21 per cent., despite the loss of over 1½ per cent. in the average ton-mile revenues. With a decreasing tonnage movement in the previous year, the management was still able to report an increase of 24½ tons in the revenue freight train load and an increase in the average freight train-mile earnings, so that with the enlarged tonnage of last year it is not surprising to find that the increases in these items of operating statistics went much beyond those shown for 1901. Thus, there was an increase of 36½ tons, or 9½ per cent., in the average revenue train load; an increase of nearly one ton, or over 6 per cent., in the average tons per loaded car, and a gain of 26c., or 7½ per cent., in earnings per freight train-mile to the high total of \$3.64. These and other interesting traffic statistics are shown below:

	1901.	1900.	Increase.	P.c. Inc.
Pass. train-miles	4,614,850	4,284,900	329,950	7.7
Miles by help'g locos.				
In pass. service	41,932	52,862	*10,930	20.7
Passengers carried	3,493,245	2,717,851	775,394	28.3
Passenger-miles	286,320,423	214,392,859	71,927,564	33.6
Ave. pass.-mile revenue (cts.)	2.327	2.290	0.037	1.62
Pass. train-mile earn.	\$1,519.7	\$1,324.5	\$0.1952	24.1
Freight train-miles	6,861,788	5,627,697	1,234,091	21.9
Mixed train-miles	777,704	881,061	*103,357	11.7
Mileage help'g locos.	307,574	304,331	3,243	1.06
Revenue tons moved	13,237,363	9,925,811	3,311,550	33.4
Revenue ton-miles	73,190,218	2,481,751	708,466	28.5
Loaded freight car miles	187,292,935	154,527,690	32,765,250	21.2
Empty freight car miles	64,312,300	44,468,560	19,843,740	44.6
Total freight car miles	251,605,235	198,996,250	52,608,980	26.4
Rev. freight train-load (tons)	417.6	381.3	36.3	9.5
Tons per loaded car	17.03	16.06	.973	6.06
Ton-mile rev. (mills)	8.59	8.71	*0.12	1.38
Earnings, per freight train-mile	\$3.64	\$3.38	\$0.26	7.7
Average freight haul (miles)	241	250	*9

*Decrease. †000 omitted.

One feature of the accounts which will attract attention is the fact that with this greatly increased passenger and freight movement there was relatively slight expansion in the maintenance charges. With an increase of 47 miles in average length of line worked and with a total of \$7,402,000 expended for maintenance of way and structures the increase in the charge is only \$300,000, and the increase in the cost of maintenance of equipment is not much greater, as shown by the figures below:

	1902.	1901.	Inc.
Gross traffic earnings, per mile	\$6.864	\$5.450	\$1.414
Operating expenses, per mile	3.889	3.045	844
Maint. of way and struct., per mile	895	846	49
Maint. of equipment, per mile	519	453	66
Net earnings, per mile	4,975	2,405	570

These maintenance charges in 1902 were only 20½ per cent. of gross receipts, exclusive of the \$2,000,000 appropriated out of surplus for betterments.

There were no significant changes in the capital stock, \$123,853,000 being now outstanding, nearly all owned by the Northern Securities Company. It is of interest to note that \$140,000 par value was issued in the past year to the employees investing company, organized to hold up to \$1,000,000 par value of stock, appropriated by the company as available for subscription at par by employees. They receive the investing company's certificates and resell their stock interest on leaving the company's employ.

The total capital expenditures are set down as \$3,882,973. The \$2,000,000 appropriated out of 1902 surplus for betterments does not seem to be available to reduce this capital charge, but to be held for improvements on the Manitoba Railway's leased lines.

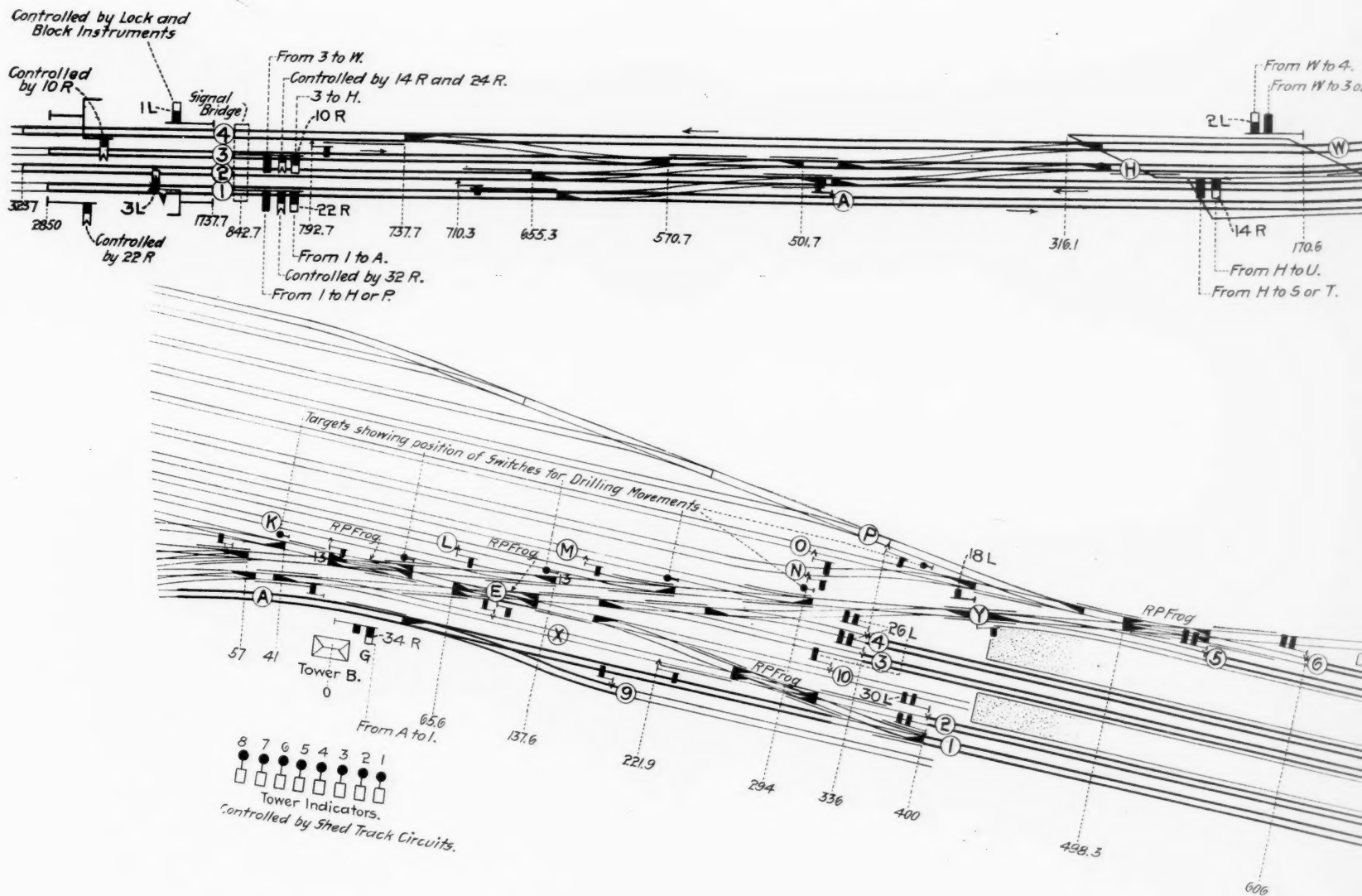
As is usual with Great Northern's reports, the text of the report gives a long account of the improvements and new equipment, over 10 pages being so taken up; but there is no allocation of the cost of this work between revenue and capital accounts. Some of the details of these improvements will be given in another article.

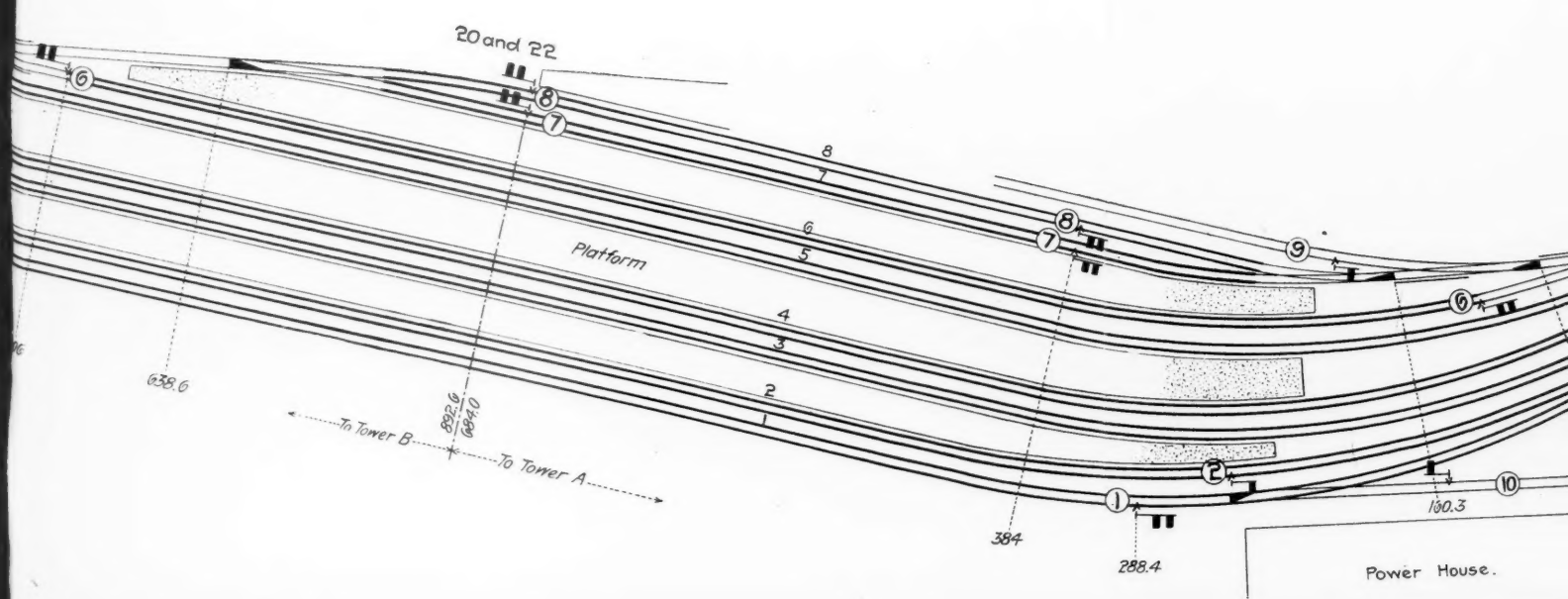
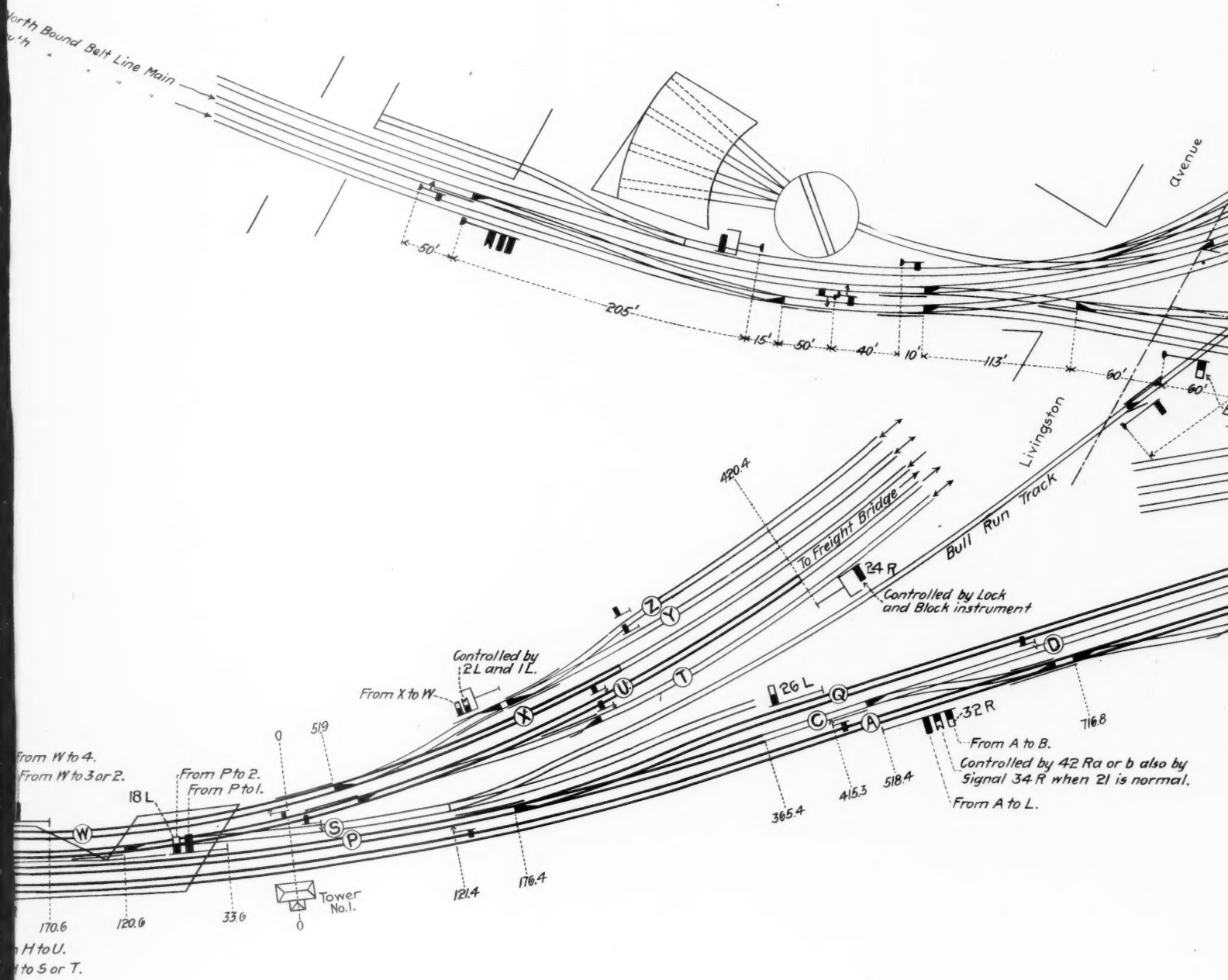
Chicago, Burlington & Quincy.—The report of this company for the year to June 30 is issued in the same form as in previous years, although all but a small part of the outstanding \$110,800,000 capital stock is jointly owned

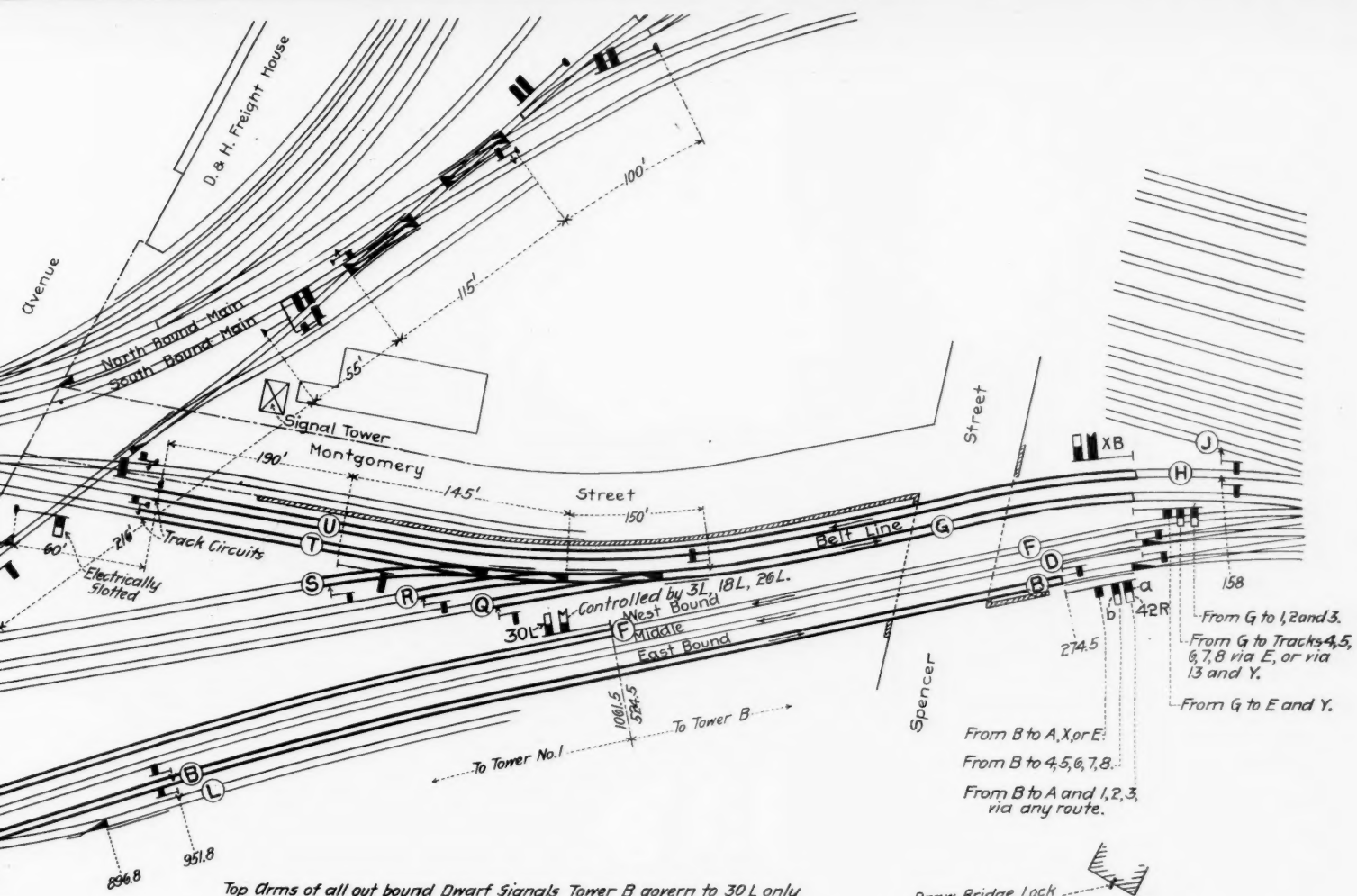
WESTINGHOUSE ELECTRO-PNEUMATIC INTERLOCKING
AT THE PASSENGER STATION OF THE
NEW YORK CENTRAL & HUDSON RIVER RAILROAD, AT ALBANY.

The right-hand end of the upper diagram joins the left of the lower. The left of the drawing is west; the right east.



The tracks marked "Belt Line" are those of the Delaware & Hudson Road.







Top Arms of all out bound Dwarf Signals Tower B govern to 30 L only and can be cleared only when all intervening signals are at clear; those leading from Tracks 5, 6, 7 and 8 govern to 30 L via crossover 13. Bottom Arms of these Signals govern in all cases to next signal in advance.

All Signals designated thus  Semi Automatic
Track Circuits controlling Signals thus 

1 2 3 4 5 6 7 8
Tower Indicators.
Controlled by Shed Track Circuits.

by the Great Northern Railway and the Northern Pacific Railway and deposited as security for the joint bonds of those two companies outstanding for \$215,154,000, the bonds being issued for twice the par value of the stock. The Chicago, Burlington & Quincy Railway also is leased to the Chicago, Burlington & Quincy Railway Company for the convenience of operation and financial control by the present owners, and to carry out an understanding in regard to the policy of the Burlington Company made with the Union Pacific as one of the terms of settlement of the contest for control of the Northern Pacific between that company and the interests allied with J. J. Hill and J. P. Morgan, which has resulted in the organization of the Northern Securities Company.

The operations of the railroad were conducted last year with the company's old organization, and in all respects as if the property had been continued under its former independent ownership. The year was a remarkably prosperous one. Gross receipts, which in the 1901 fiscal year had for the first time exceeded \$50,000,000, increased \$3,743,300 beyond these figures to a total of \$53,795,245, with an addition of only 212 miles to operated line. Net earnings were above \$18,112,000, increasing in the year by \$2,129,300, the operating ratio having fallen 1½ per cent. to 66½ per cent. Per mile of standard gage railroad, gross receipts are now at the high figure for a railroad serving an agricultural country, of \$6,634, this figure comparing with \$6,405 in 1901.

Of the increase in gross receipts \$2,410,000 was contributed by the freight department, and this is all the more noteworthy because there was a decrease of ⅓ of a mill (a larger decrease than in any recent year) in the gross earnings per ton-mile. There was, however, a noteworthy saving in the train service, there being an actual decrease in miles run by freight trains on standard gage roads of 843,845, or about 4½ per cent., despite the increase of 742½ millions, or nearly 19.2 per cent. in the revenue ton-miles. The increase in passengers carried one mile amounted to over 12½ per cent., and the increase in passenger train-miles to nearly 11 per cent. The gain in passenger revenues was 10.60 per cent., the decrease in the passenger-mile rate having been ⅓ of a mill.

The income account for the last two years follows:

	1902.	1901.	Increase.
Gross earnings.....	\$53,795,245	\$50,051,989	\$3,743,256
Oper. exp. and taxes..	35,682,876	34,068,908	1,613,968
Net earnings.....	\$18,112,370	\$15,983,081	\$2,129,289
Total net income.....	18,453,175	16,363,879	2,089,296
Fixed charges.....	8,370,064	8,238,471	131,593
Surplus.....	\$10,083,111	\$8,125,408	\$1,957,703

Out of the surplus above, for 1902, there was paid \$213,602 in dividends on stock not deposited, and \$8,606-120 interest on the bonds issued by the Great Northern and Northern Pacific Railways with Burlington stock owned as collateral. This left a balance for the year of \$1,263,389.

Funded debt charges given above include contributions to the sinking fund account of the company whose sinking fund charges exceed, in aggregate amount and relatively to the interest accruals, those of any other railroad in the country. Last year \$623,131 was paid directly from earnings of the year, and the remaining \$566,011 represented accumulated interest on uncanceled bonds held in the sinking funds, and with this \$1,189,142 income \$1,203,600 bonds were purchased, of which \$405,000 were cancelled and the remainder, \$798,600, are held uncanceled in sinking fund investments. The total sinking funds amounted to \$19,163,148 on June 30 last, the sum having been reduced in the year by the company paying off and cancelling the \$2,087,000 sinking fund 5 per cent. bonds due Oct. 1, 1901, by which there was released \$2,436,097 held in the sinking fund for those bonds, and covered into the company's treasury on maturity and cancelling of the issue.

Other changes in the funded debt in the past year were the issue of \$7,578,000 bonds bearing 3½ per cent. interest for improvements, etc., besides the issue of \$1,397,000 bonds of the same issue, to retire an issue of 7 per cent. bonds maturing in 1903. Changes in mileage of the year comprised chiefly the branch from Toluca, Mont., to Cody, Wyo., 130 miles, which has been under construction for some time. With this and other mileage, the Burlington system now comprises 8,124 miles of road, of which 423 miles is double tracked, 41 miles of second track work having been done in the past year. Total construction expenditures charged to capital account in the past year amounted to \$4,960,400, and \$1,027,817 cost of new equipment was also charged to capital account. These charges are exclusive of construction and expenditures on the narrow gage roads and on lines controlled, which amounted to about \$257,000 additional.

Lehigh Valley.—The report of this company is issued for the year ending June 30, the fiscal year of the company having heretofore ended on Nov. 30. The present report therefore includes the operations of only seven months which have not heretofore been reported, but the statistics throughout have been arranged to give comparisons for the twelve months to June 30 in each of the last two years. The revenues in the seven months since the date of the last annual report—that is, from Nov. 30, 1901, to June 30 last—were seriously affected by exceptional circumstances, heavy floods having caused serious damage in February, 1901, and again in February and March, 1902, and the anthracite coal miners' strike stopped mining from May 12. The loss in gross revenues from these causes, by interference with traffic, is esti-

mated by President Walter as not less than \$3,000,000, in addition to the cost of repairing flood damages, estimated at \$886,000, of which \$562,000 is included in the expenses to June 30 last. In these seven months the gross earnings of the railroad company from operations were \$12,640,456, net earnings from operations \$1,131,742, and there was a deficit, after paying fixed charges, etc., of \$2,120,715. The Lehigh Valley Coal Company for this period reports gross income of \$10,807,000 and a deficit of \$310,526, after all charges.

The yearly comparisons make a relatively better showing, though losses in revenue and traffic with increased expenses are reported. Earnings from coal traffic were \$307,800 less than in the year to June 30, 1901, but the loss of gross revenue from the strike of anthracite miners is estimated at \$1,920,000, and the losses of freight and passenger revenue from the floods of the winter are estimated at \$780,000. These were not the only adverse factors which the management had to confront in the past year, for there were also heavy losses in grain and other traffic. In grain alone the decrease from the previous year was 640,000 tons, or 32 per cent., and the total decrease in products of agriculture was 730,000 tons. The decrease in the number of tons of anthracite coal moved was 915,300, or 10½ per cent., and there were decreases in certain other items, though none very large in itself.

On the other hand, there was considerable expansion in various items of low-grade freight, such as an increase of 372,400 tons in ores carried, this traffic being 1½ times larger than in the previous year; an increase of 159,000 tons, or 14½ per cent., in soft coal and coke; a gain of 330,200 tons, or nearly 26 per cent., in cement, brick and lime, with large expansion in other classes of building materials and in general merchandise tonnage. The net result of these changes in traffic was a decrease of 336,200 tons, or 1.8 per cent., in total revenue tons moved, and a decrease of 187,800,000 ton miles, or about 5 per cent. Through a gain in the average ton-mile revenue there was an increase of about \$47,000 in total freight revenues in the year, enhancement of \$355,000, or 3.8 per cent., in the revenue from general freight offsetting the loss in coal freights. The increase in passenger earnings was also exceptionally large, \$675,000, or 22½ per cent., due to business created by the Pan-American Exhibition at Buffalo a year ago.

This larger passenger movement seems to have been so handled as to bring considerable profit to the company, for there was only nominal increase in the number of passenger train-miles run. There was an actual decrease in the total cost of conducting transportation of \$243,800, or 2½ per cent., corresponding fairly closely to the decrease in ton mileage in the year. Maintenance charges, however, expanded much more than the enhancement in gross, or by \$1,224,000, or 15½ per cent., the maintenance charges of the Lehigh Valley for years past having consistently shown heavy expansion in maintenance items. The result of the year's operations was that with gross transportation receipts of \$25,971,500, or \$830,250 (3.3 per cent.) more than in the previous year, the company ended the year with a reported deficit of \$1,332,800, or \$234,500 more than in the previous fiscal year. The income account for the last two years follows:

	1902.	1901.	Increase.	P. c.
Earnings—				
Coal traffic.....	\$9,328,959	\$9,636,802	-\$307,843	3.2
General freight....	9,627,286	9,272,317	354,969	3.8
Passenger.....	3,664,820	2,989,004	675,816	22.6
Gross earnings....	24,272,254	23,482,567	789,687	3.4
Operating expenses..	19,652,118	18,668,024	984,094	5.3
P. c. exp. to gross..	80.97	79.50	1.47	...
Net earnings.....	\$4,620,136	\$4,814,542	-\$194,406	4.0
Taxes.....	615,467	622,805	-\$7,338	1.2
Net loss, water lines.	72,658	190,574	-\$117,916	61.9
Net income.....	\$3,932,011	\$4,001,163	-\$69,152	1.7
Miscellaneous inc..	1,079,367	1,081,371	-\$2,004	0.2
Total net increase\$	\$5,011,378	\$5,082,534	-\$71,156	1.4
Fixed charges, etc.	6,344,155	6,180,847	163,308	2.6
Deficit.....	\$1,332,777	\$1,098,313	\$234,464	21.4

*Decrease.

The gross receipts above are those of the rail lines and exclude \$1,700,000 received from the Lake boat lines and the lighterage and towing lines in New York Harbor, etc. These water lines showed a deficit for the year of \$72,658, carried into the accounts as noted above.

All the company's expenditures for improvements, new equipment, etc., seem to be charged directly to operating expenses through maintenance accounts in accordance with previous policy, except \$560,000 on account of 40 new engines, for which car trusts for that amount were issued. On the other hand, besides the cost of replacing all equipment taken out of service against expenses, the company charged \$232,300 for the principal of maturing car trusts and a proportion of the cost of the 40 locomotives secured by the new car trusts. An itemized summary of the improvement work of the year shows total expenditures on this account of \$1,676,974 out of the total charge of \$4,633,000 for maintenance of way. The larger items were for strengthening and repairing bridges, stone ballasting, fuel and water stations, etc. The changes in expenses are shown below:

	1902.	1901.	Increase.	P. c.
Conduct'g trans..	\$9,130,530	\$9,374,299	-\$243,769	2.6
Maint. of way and structures....	4,632,997	4,241,717	391,280	9.2
Maint. of equip..	5,149,924	4,316,862	833,062	19.3
General expenses..	738,667	735,146	3,521	0.5
Oper. expenses....	\$19,652,118	\$18,668,024	\$984,094	5.3

*Decrease.

The maintenance expenses included \$562,000 out of a total estimated expenditure of \$886,000 required to repair flood damages. The report notes that much progress was

made in bringing the physical condition of the property to a higher standard and it is stated that 293 miles of track are now laid with stone ballast and 896 miles protected by automatic signals. Last year the company put down 21,575 tons of new steel rails over a total of 2,002 miles of main and second track etc.

Despite all the work of recent years in the improvement of the physical condition of the Lehigh Valley Railroad and in adding to its transportation facilities, President Walter states that additional expenditure is necessary in greater volume than can be secured out of the current income of the company which has been heretofore the chief source of funds for this class of work. He points out in the report, as in those for the two previous years, "the necessity for procuring additional capital to provide funds to place the property of the company and its auxiliary companies at a standard of efficiency and economical working with due consideration for the character of the traffic transported, a very large proportion being hauled at exceedingly low rates," and further that while net earnings will provide part of the cost of this work, "some financial plan must be adopted by which funds from other sources may be obtained." The stockholders at their annual meeting, acting on this suggestion, have authorized the directors to issue collateral trust bonds of the company for these purposes, though the amount of the issue does not yet seem to have been fixed or is not publicly announced.

The leading traffic statistics of the year are compiled below:

	1902.	1901.	Increase.
Miles worked.....	1,387	1,386	1
Passenger train-miles.	4,010,713	3,993,877	16,836
Pass. & exp. train-miles	4,288,124	4,304,354	*16,230
Passengers carried...	4,308,497	4,456,732	*148,235
Passenger-miles....	208,561,926	160,953,677	47,608,249
Pass.-miles per mile.	150,333	116,125	34,218
Aver. pass.-mile revenue (cts.).....	1.757	1.857	*0.100
Freight train-miles...	7,323,684	7,775,099	*451,415
Freight engine miles			
Inc. help. & empty..	8,930,664	9,787,739	857,075
Rev. tons moved, local freight.....	6,466,345	6,694,670	*138,325
Rev. tons moved, interline freight....	11,708,541	11,906,393	*197,852
Tot. rev. tons moved.	18,174,886	18,511,063	*336,177
Rev. ton-miles.....	3,418,885	3,606,698	*187,813
Ton-miles per mile...	2,464,523	2,602,160	*137,637
Load. fr'ght car-miles.	176,081,318	185,789,699	*9,708,381
Empty fr'ght car-miles.	78,181,733	88,710,470	*10,528,737
Rev. fr'ght trainload.	467	464	3
Rev. trans. including help. eng. mileage.	427	417	10
Tons, per loaded car.	19.42	19.41	.02
Ton-mile rev. (mills).	5.54	5.24	0.30
Earnings, freight-train mile.....	\$2.59	\$2.43	\$0.16
Av. fr'ght haul (miles)	188	195	*7

*Decrease. †000 omitted.

It will be noted that with the losses of tons in anthracite coal, grain and other freight moving in bulk, the revenue freight train-load was increased. Including company freight the average number of tons per train was 488, or 3.98 tons more than in 1901; while including helping engine mileage, the train-load was 11.3 tons above the 1901 record at 446 tons, a high figure for a road situated like the Lehigh Valley R. R.

The United States Circuit Court for the Northern District of Iowa, in an opinion by District Judge Shiras, has decided some interesting points touching upon the Federal Law requiring the use of automatic couplers on freight cars. It is held that a car designed for interstate traffic is subject to the law, even if it be running empty, and it is a violation of the law to permit a coupler originally sufficient to become worn out and inoperative. The suit was that of Voelker vs. the Chicago, Milwaukee & St. Paul, and it was decided in favor of the plaintiff. The railroad company has appealed to the Circuit Court of Appeals. Voelker was a brakeman in a yard crew and rode a car which was kicked into a side track. Another car was standing there and the moving car, on striking it, rebounded a few feet, the knuckles on both being closed. Voelker then got down and went between the two cars to adjust the couplers so that when the engine should kick back more cars these two would couple together. While he was doing this, the second car came, unexpectedly, and he was fatally crushed. The essential head notes of the decision are, in substance, as follows: Though the plaintiff did not mention the Federal Law of 1893 (requiring automatic couplers) he may have the benefit of that law. (It appears that the law of Iowa is similar to the Federal law). The petition in the case did not allege that the car was being used in connection with interstate commerce, but the fact appeared in the evidence, and, therefore, the lower court rightfully instructed the jury that the Federal law was applicable. This law applies to cars designed for interstate traffic, though at the time they are being hauled empty. Failure to equip a car with a workable automatic coupler, by reason of which failure the man was obliged to go between the cars, is held to have been a proximate cause of the accident, though the cars were forced together by the negligent kicking of other cars against them. To permit a coupler to become worn and inoperative violates the law, although the coupler was originally sufficient. The lower court was asked to instruct that the deceased assumed the risk because it was the custom to kick back cars without giving him notice, but this instruction was refused, and properly, no reference having been made in the testimony to his knowledge or means of knowledge on this point. It was claimed that the other members of the crew were bound to see that Voelker had found it necessary to go between the cars, but this claim is disallowed. Other points are mentioned, but they deal mainly with technical questions of legal procedure; the gist of the opin-

ion is contained in the foregoing. The essence of the decision appears to be that Voelker was obliged to go between the cars because the coupler on the standing car was defective, and this is held to settle the case in his favor (his administrator got \$9,000), without much regard to the customs of switching or the responsibility of the other members of the crew. The decision is not very clear to the lay mind, and the fact that the defendant has appealed would seem to indicate that legal minds have their doubts. Both knuckles being closed, the moving car could not possibly have coupled to the standing one, and yet the decision speaks of the defective condition of the coupler on the standing car as the cause of their not coupling. The knuckles being closed, the question would naturally arise why Voelker did not stop his car before it touched the other one. This, however, would probably have no direct bearing on what occurred after the car bumped and rebounded. The law (Section 8) says that an employee injured by any car in use contrary to the provision of the act shall not be deemed to have assumed the risk occasioned by such unlawful use.

TRADE CATALOGUES.

Saw Mill Machinery.—The Allis-Chalmers Company, Home Insurance Building, Chicago, Ill., sends an illustrated catalogue of 226 pages devoted especially to saw mill machinery and supplies. The mills illustrated cover pretty much the whole range of the most improved designs of hand saws, both double cutting and single, of gang saws and single mills and an immense variety of saw mill apparatus. Devices of remarkable ingenuity are illustrated by very good engravings. These include saw mill edgers, trimmers and slashers, lath mills, transfer machinery, filling room tools and engines. The volume is provided with an alphabetical index. The company has branch offices in seven of the principal cities of the United States and also in London.

The Steam Turbine—Its Commercial Aspect.

(Continued from page 817.)

horse power per hour was guaranteed on a turbine of 750 k.w. capacity, corresponding to about 10.17 lbs. per i.h.p., which, though the size is moderate, is perhaps within the ability of but few engines, of any size or type, that have ever been built.

It may be pertinent to cite a few results obtained in regular service. The turbine at Hartford, under test conducted by Prof. Robb, at an average load of 1,800 k.w., with 155 lbs. steam pressure, 27 in. vacuum and 45 deg. superheat, gave a result of 19.1 lbs. of steam per kilowatt hour; or an equivalent of about 11.46 lbs. per i.h.p. hour. An interesting comparison has been made at this plant of the relative efficiency, under regular operating conditions, of the turbine and their Corliss engines. They have one 18 and 34 x 48, and one 24 and 44 x 60 cross-compound horizontal Corliss engine. These engines drive direct by belt one 400 k.w. and one 600 k.w. generator. The turbine is, of course, direct-connected to its generator. They have made comparisons of operation based in each case on rather extended runs. It has been found that the turbine requires in delivering 1,000 k.w. on the board about the same amount of coal that is used with the Corliss engines to deliver 925 k.w., the steam pressure and vacuum being identical in both cases; and this with the engines running at about their point of best efficiency, and known to be in excellent condition. Comparisons of this kind, while not scientifically exact, are perhaps of greater interest as a measure of commercial performance.

The data at hand of tests on one of the 400 k.w. turbines at Wilmerding shows a result of 16.4 lbs. per electrical horse-power hour at full load, with 125 lbs. steam pressure and 26 to 27 in. vacuum. At half load it is 18.2 lbs.

At the Elberfeld Municipal Electricity Supply Works in Germany, two 1,500 h.p. Parsons turbines, which are run in parallel with two Sulzer horizontal engines, were tested by Prof. Schroter, Dr. Weber and Mr. Lindley. With steam pressure averaging 95 lbs., running condensing, and with 18.3 deg. of superheat, the result obtained, at maximum load, was 19 lbs. per k.w. hour; or about 11.4 lbs. per i.h.p. hour.

But is its efficiency maintained? A question often asked, and a very important one, too. Looking at the turbine casually, it seems as though there would be little opportunity for any change in its mechanical functions.

A recent interesting investigation along this line was made at the plant of the Cambridge Electric Supply Co., Limited, in England, where they have a 500 k.w. Parsons turbine. The outfit was erected in January, 1900, and during the past year has been doing very constant work. After it had operated about eight months, a second one was installed. The first outfit had been tested at the maker's works before shipment and showed a result of 24.1 lbs. of steam per k.w. hour at 526.4 k.w. And it was for the purpose of noting its performance after a year's operation that Prof. Ewing conducted recently a second test. In this latter test the turbine at 518 k.w., under nearly equal conditions of steam pressure and vacuum, gave a result of 25.0 lbs., and at 586 k.w., 24.4 lbs. In the second instance the turbine, besides trouble experienced with wet steam, was driving its own air and circulating pump (a surface condenser being used), and the steam required to drive these auxiliaries was charged to it. In the test at the builders'

works, the turbine did not drive its pumps. The results, to use Prof. Ewing's words, give most satisfactory evidence that the turbine retains its character as a highly efficient generator.

The Westinghouse Company is now erecting a new testing room in which a complete plant of boilers, condensing and superheating apparatus will afford facilities for testing turbines up to 3,000 h.p., at all loads up to full capacity, and larger units up to this point, with practically any steam pressure and wide ranges of vacuum and superheat. Thus, the conditions to be met in practice may be approximated in the shop, and the information acquired will be of the highest value.

A plant was recently laid out to contain three 1,000 k.w. units, with vertical cross-compound Corliss engines. Subsequently, three more 1,000 k.w. units were contracted for, steam turbines being ordered. It was found that the turbine saved 900 sq. ft. of engine-room floor space, and about 38,000 cu. ft. Had the whole plant been originally designed for turbines, the saving of space would have been double these amounts, and the cost of land, building and foundations been reduced about \$50,000.

One other case, of perhaps greater interest, recently came to notice, that of a plant of 8,100 k.w. capacity, laid out on modern lines, employing vertical cross-compound condensing engines. It was shown that without going beyond the present building walls, and without disturbing the existing machinery, the plant might be doubled in capacity by installing turbines in the space available below the present engine-room level and adding another deck of boilers. And it has been figured that this arrangement would effect a reduction of over three dollars per kilowatt per annum in the present interest charge.

It may be assumed that the larger field for the turbine begins about where the high-speed engine leaves off. The comparison, then, lies generally between the turbine and the slow-speed engine. It remains merely to take an engine and generator of good construction, bring the engine efficiency as nearly as possible into parity with that of the turbine, also having it possess the same overload capacity, to find that the turbine is reasonable in price. And when we add the possible saving in foundations, buildings, etc., the first cost of installation is usually much in its favor.

The turbine is especially adapted to parallel operation in that there is no fluctuation of angular velocity. There is but one direction of motion, with no element to detract from even turning moment, and due to its speed there is stored up more fly-wheel effect than is present in the piston engine.

It is, therefore, found that not only do steam turbines easily run together in parallel, as hydraulic turbines have always done, but it may be expected that they will operate with piston engines and the performance of the latter in this respect be much improved. In electric railroad work especially is this feature of the steam turbine of much interest, for it is well known how irregular loads accentuate the difficulties of regulation.

The feature next in importance, perhaps, is that of superheated steam. It is now quite generally recognized that superheating is of advantage, though there is still much about it to be learned. Engine builders themselves are feeling their way, for while some appear to unrestrictedly offer the Corliss valve for superheat work, others seem prone to confine it to the more conservative temperatures, and others still reject it altogether and hold to the poppet valve where superheat is employed.

The turbine may be used unreservedly with superheat of any feasible temperature. It has no internal rubbing surfaces, and there are no glands to become injured. Also, as no cylinder oil is required, there is no opportunity for lubricating trouble. Furthermore, there seems to be with the turbine rather more proportionate benefit from superheat than with the piston engine, because of diminished skin friction.

Having said that the turbine requires no cylinder lubrication, the inference follows that the steam is therefore uncontaminated with oil, and that the exhaust, when condensed, is pure distilled water. In many sections of the country, where the water contains either mud or scale making impurities, the cost of repairs to boilers, with the expense in labor and interruption of service entailed by constant cleaning, is a besetting evil.

To recur once more to this feature of lubrication in the turbine, it may be remarked that it is an item of very little expense. The bearings are the only points requiring oil, the lubricant being circulated around under pressure. The reservoir being once charged, very little is needed to maintain the supply.

DISCUSSION.

Attention was called to the fact that the relative cost of the generator to be attached to the turbine was not brought out in the paper and the question asked whether the statement that the turbines cost less meant that this reduced cost is due to the reduced cost of the generators rather than to the turbines.

It was said in reply that since turbine units were offered as complete outfits by their builders in this country it was immaterial what the constituent parts cost. The comparison was on the complete unit, as against the reciprocating unit.

It was then suggested that it was important to builders of power plants to know the cost of the various elements going to make up such plants, and that the separate cost of the generators should be known. Furthermore, that while at the present time the only builders of tur-

bines in this country are also builders of electrical equipment, the turbine is entirely independent of the electric generator and its manufacture would doubtless be undertaken by other concerns. An important point in comparing with reciprocating units is the effect of the greatly reduced cost of the generator to be attached to the turbine as a result of the much higher speed at which it is run. The limiting speed for turbines is 750 r.p.m., while Corliss units, representing the highest attainable efficiency for reciprocating units and running at 68 r.p.m., require generators of excessive weight and cost, as a result of this slow speed.

In reply to a query regarding a guarantee as to the cost of maintenance of the turbine, Mr. Sniffin, who spoke from the manufacturer's standpoint, said that past experience justified the claim that when properly built, steam turbines should cost less for maintenance than reciprocating engines. That he did not think it possible to get a guarantee of repairs on the latter, or on any piece of moving machinery. However, the manufacturer would be willing to make for the turbine the same guarantee as to maintenance that he would make for any other piece of machinery he produces. In regard to the sub-division of the cost of the turbine units, the turbo-generator must be developed as a complete entity; the constituent machines must bear the proper relation to one another.

A member pointed out that what data exists at present on the performance of turbines are for comparatively small units. Whether the same results will be obtained on large units remains to be demonstrated.

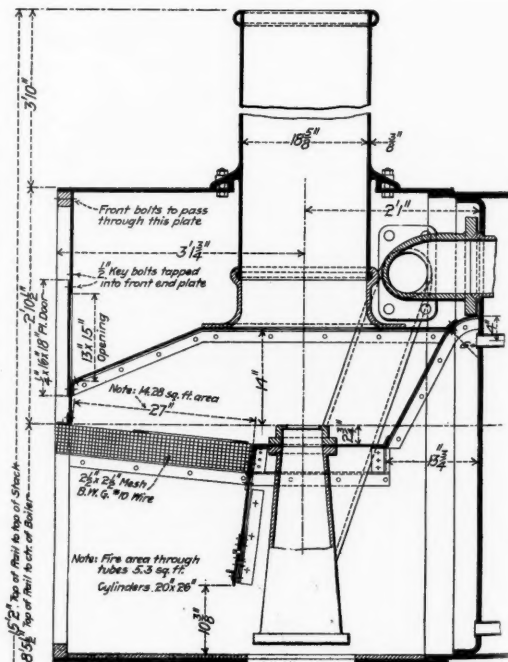
It was stated that turbines do not require individual condensing plants, though for larger units such an arrangement might probably prove advantageous. It was thought that turbine condenser plants are somewhat more expensive than those for ordinary engines, although detailed reasons for this belief were not given beyond mention of the requirement for larger exhaust piping and the more careful work required on it.

One of the difficulties with turbo-generators at the present time is not so much mechanical as electrical; in fact, turbines are not successful in direct current generation. In this application the units make considerable noise, the cause for which is attributable to peculiarities in the design of the generators. The turbine at the present time is much better adapted to alternating current generators.

In closing Mr. Sniffin said that the impression seemed to prevail that the turbine is still something of an experiment. He sought to disprove this by the citation of various facts and data.

Front-end Arrangement of the Intercolonial Railway of Canada.

At the Master Mechanics' Convention in June last, Professor Goss discussed somewhat briefly the advantages of the inside stack. The principal point made was that within limits common to practice, any stack should be as long as possible. In cases where the length of exposed stack is necessarily short, the advantage of a greater



Front-End Arrangement of the Intercolonial Railway of Canada.

length can be secured by allowing the lower end to run into the smoke-box. The effect of his discussion was to commend the inside stacks.

In this connection, the practice of the Intercolonial Railway of Canada will be of interest. By the courtesy of Mr. J. E. Muhlfeld, we are in receipt of a front-end design which evidently possesses unusual merit and which, we are informed, is giving excellent results on 25 different engines. By reference to the figure, it will be seen that in Mr. Muhlfeld's arrangement, the

height of the smoke-box is cut down to limits considerably below that which the diameter of the boiler allows.

The Local Railroad of the St. Louis World's Fair.

Mr. Taylor, Director of Works, has received from Weston Brothers, of Chicago, a tentative lay-out of the intramural railroad, which will carry visitors around the fair grounds. It provides for a third rail railroad 9.66 miles long to traverse the exposition grounds in three loops of widening circumferences which coincide at their eastern end. Each loop may be worked as a separate system employing different cars. On all the loops the cars are designed to run in the same direction as the hands of the clock. The cars on all the loops are to run over the same track at the eastern end of the grounds, where will be the starting point and the main station for all the intramural loops, and it will be possible for a visitor to board a car there for any point in the grounds that he desires to reach. Weston Brothers will make a more detailed report regarding the system within a month. At that time they are to have plans and specifications made up so that the contract for building may be let at once.

TECHNICAL

Manufacturing and Business.

The Adamson Stock Car Co. has been incorporated in New Jersey, with \$125,000 capital, by K. K. McLaren, Louis B. Bailey and Paul Tisson.

The Lunkenheimer Company has issued invitations for the opening of its Fairmount Works, Beekman, Tremont, Lawnway and Waverly avenues, Fairmount, Saturday evening, Oct. 25, at 8 o'clock.

The Caswell Car Co., Chicago, under pressure of rapidly increasing business, has removed its offices from 406 Fisher Building to more spacious quarters in suite 1610-11-12, Fisher Building, Chicago.

The Railway Steel Spring Co. has taken over the Railway Spring & Mfg. Co., of Washington, Pa., and it is said that the consolidation is now complete, it having taken over all the companies originally intended.

The United States Car & Vehicle Co. has been incorporated in Maine, with a capital stock of \$1,000,000. It will make and deal in all kinds of railroad cars. John M. Benton, of Boston, Mass., is President, Chas. W. Coolidge, Jr., of Manchester, N. H., is Treasurer.

The Philadelphia Pneumatic Tool Co. states that its business for the month of September amounted to 20 per cent. more than any previous month. During the current month the monthly record for foreign shipments has already been broken, large orders having been received from Great Britain, Germany, France, Italy and Denmark. Chas. G. Eckstein, the German representative of the company, arrived in New York on the 17th inst., and will probably remain some weeks.

In order to largely increase its manufacturing facilities the John N. Poage Mfg. Co., of Cincinnati, has leased for a term of years the six-story brick building, 35 x 90 ft., adjoining its works. This adds about 20,000 sq. ft. of space to the Poage plant, and it is all needed. The company has gone into the manufacture of gate valves and the "Little Giant" switch stand. It recently shipped in one day four carloads of Poage's water columns to the Chicago Great Western Railway, and this was shortly afterward followed by a shipment of another car loaded with Poage's columns.

A paint which the makers say is ideal for use on iron and steel structures and known as Rustless Blue Lead is made by the American Graphite Co., Cleveland, Ohio. This paint is said to remain in perfect condition whether in paste or liquid form, something that cannot be claimed for many other paints; to have high qualities of elasticity and durability, reducing to a minimum the possibility of cracking under expansion and contraction of the metal; to cover a larger surface per gallon on uneven surfaces than red lead; and to be in perfect harmony with iron and steel because of its gray-blue color. A photograph the company has of a section of an iron column, exposed for nine years, shows two surfaces, one of which was not painted and was therefore badly corroded. The surface coated with the rustless blue lead is apparently in as good condition after nine years as when originally painted.

One of the exhibits attracting the most attention at the recent Street Railway Convention at Detroit was a private car intended for interurban electric lines. The car, which was built by the G. C. Kuhlman Co., was very handsomely finished both inside and out. All of the finishing material used throughout was the product of the Sherwin-Williams Co., including primer, surfacer, colors, varnishes, truck paint and roof paint. This company also had a very attractive exhibit in Exhibit Hall, at which were shown building paints, bridge paints, pole paints and varnishes. A set of colored plates, suggestive of attractive combinations for street cars, received much attention and favorable comment. Another interesting feature was an old rattan seat, one-half of which was finished with Sherwin-Williams rattan seat enamel, a new article, demonstrating that this class of equipment can be economically renovated and made to appear as well or even better than it did originally. The company was represented at Detroit by E. M. Williams, Manager of the Street Railway Sales Department; F. A. Elmquist, Thomas Madill and E. S. Blanchard.

Iron and Steel.

Negotiations are under way for a consolidation of the leading forge companies of the country.

A Berlin despatch says the Hördor Iron Company has received an order from America for 40,000 tons of rails.

The Missouri Bridge & Iron Co., of St. Louis, Mo., has been incorporated under the laws of the State of Illinois.

The Philadelphia & Reading is said to be negotiating with the Pennsylvania Steel Co. for 100,000 tons of heavy rails for delivery next year.

The La Follette Coal, Iron & Railway Co. has recently put in blast its new iron furnace at La Follette, Tenn. Its daily capacity is 350 tons.

The Michigan Steel Casting Co. has been incorporated with \$300,000 capital. Karl R. Davies and Fred. J. McMurtie are the incorporators.

Harry Menough, Superintendent of the Mingo steel plant, has resigned and will engage in making steel castings with a new company at Wellsville, Ohio.

The Alger Iron Foundry Co. has been incorporated in Maine by Howard P. Wilbur, of New Bridgewater; Albert F. Barker, of Brockton, and Frederick L. Jerris, of Portland.

Plans are said to be under way to consolidate several of the large iron foundries in Toronto. The Canada Foundry Co., controlled by Frederick Nicholls, will be the nucleus of the enterprise.

A report from Bridgeport, Conn., is that the Locke Steel Chain Company, Limited, capital \$1,000,000, has been organized in London to manufacture under the patents of the Locke Steel Belt Company.

The Southwestern Bridge & Iron Co., recently incorporated, was formed to consolidate the Wichita Bridge & Iron Co., of Wichita, Kan., and the Oklahoma Bridge & Steel Structural Works Co., of Enid, Okla. T.

The Shenango Furnace Co., the Clairton Steel Co., the Jones & Laughlin Steel Co. and the Union Steel Co. have just closed negotiations for large tracts of ore lands in the Northwest which will supply them with raw material for many years to come.

Grant B. Schley, President of the Virginia Iron, Coal & Coke Co., has resigned, and Henry K. McHarg, heretofore one of the Receivers, has succeeded him. Mr. McHarg has also been made President of the Virginia & Southwestern Railroad owned by the V. I. C. & C. Co.

Application will shortly be made in Pennsylvania for the incorporation of the Sharon Ore & Furnace Co., a subsidiary of the Sharon Steel Co. It is proposed to build two large blast furnaces at a total cost of \$1,500,000. The officers will be the same as the Sharon Steel Co. and the plant will be in South Sharon, adjoining their other mills.

Pig iron consumption this year, according to the computations of the *Iron Trade Review*, will exceed 18,210,326 tons, which is two million tons more than last year and five million tons, or 40 per cent., more than 1900. The pig iron production for the last half of this year is not likely to exceed that of the first half, because the difficulty of getting coke has already hampered many of the furnaces, yet the production in the third quarter is at almost identically the same rate as the production of the first two quarters, and if this rate is maintained for the rest of the year the production for the 12 months will be 17,652,918 tons. For the eight months ended Aug. 31 the reduction in stocks was 136,598 tons. The imports for the eight months were 257,210 tons and exports in the same time were 22,203 tons.

Per Diem Charges.

The Secretary of the Master Car Builders' Association announces that the Per Diem Arbitration Committee of the American Railway Association has adopted the following resolution: "Whereas, The Master Car Builders' Association, through its Arbitration Committee, proposes to make allowances in the charges for the repairs to cars to cover per diem due on cars held for repairs when such repairs are chargeable to the owners of cars; Resolved, That the committee decides that in such case no allowance or reclaims can be made for detention of car."

This action reverses the former decision rendered by that committee, and the suggestion of the M. C. B. Arbitration Committee that an additional charge of 20 cents per day be made against owners of cars while undergoing repairs of owners' defects becomes null and void.

Cast Iron Wheels.

The Committee on Cast Iron Wheels of the Master Car Builders' Association expects, within the next two or three months, to send out a circular of inquiry concerning wheel failures and breakages, and asks that each member maintain as complete a record as possible of all wheel failures and their causes that have occurred on their road, to help the committee in making its annual report to the convention next June.

Tests of M. C. B. Couplers.

The committee has sent the following circular to the members: At the last convention of the Master Car Builders' Association the following resolution was adopted:

"Resolved, That the Master Car Builders' Association recommend to its members that in purchasing M. C. B. couplers they specify that the link slot and link pin

hole be omitted, and that, in that connection, the Standing Committee on M. C. B. couplers shall make an inquiry and report to the convention next year the results obtained by that change."

Your Standing Committee on M. C. B. Couplers wishes you to keep the matter in mind, and to use the solid knuckle as far as possible. During the early part of next year you will be asked for a report of results obtained from this change, and we hope you will have some definite information to give at that time. R. N. Durborow, Chairman.

Master Car Builders' Standards.

New lithographs are being prepared showing the changes in standards and recommended practice. Changes and additions have been made in Sheets M. C. B. 7, 9, 11, 13, 14, 16, 17, 19, 22, A and G. The size of these lithographs is 30 by 38 in., and they are of such quality that blue prints can be taken from them. A full set consists of 30 sheets, 22 devoted to standards and eight to recommended practice. They will be ready for distribution in about two weeks, and are sold at 25 cents per sheet or \$7.50 per set. A pamphlet containing the text of standards and recommended practice, and also reduced illustrations, is ready for delivery, and is sold at 50 cents per copy. The Rules for Loading Long Materials and also the Air-Brake and Signal Instructions were not revised at the last convention, but can be furnished in any desired quantity. An index of the proceedings of the Association from Volume I (1867) to Volume XXXIV (1900) has been prepared and is now ready for distribution. It is bound in cloth and is sold at \$1.00 per volume, plus postage 10 cents when sent by mail. The reports of proceedings are being distributed, and each member will receive a number equal to the number of votes he has in the Association. Additional copies can be had at \$1.50 per copy. The decisions of the Arbitration Committee in Cases Nos. 1 to 603, inclusive, have been reprinted in book form, bound in cloth. These volumes can be furnished at \$1.50 per copy. Orders should be sent to Jos. W. Taylor, Secretary, Rookery Building, Chicago, Ill.

Power Brakes for Street Cars.

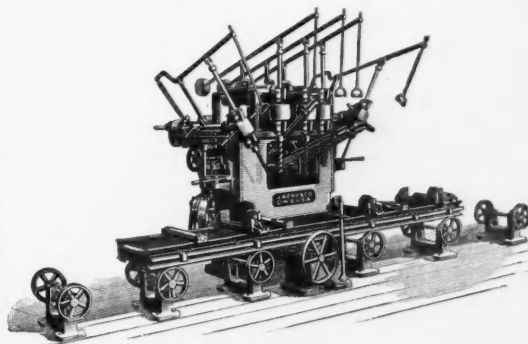
The St. Louis & Suburban Railway Company, of St. Louis, has ordered power brakes for all of its cars, 130 in number. The brake selected is the Standard Traction Company's (Westinghouse Co.) compressed air-brake, with motor driven air compressor. The fact that a car was equipped with this brake is said to have saved the life of a little girl in St. Louis a week or two ago. The St. Louis Transit Company, which operates about 1,000 cars, claims that the city ordinance requiring power brake equipment is defective and illegal, and the matter of enforcing this ordinance is now in the hands of the Mayor.

Contract for Charleston Dry Dock.

The Navy Department has let the contract for building the first granite and concrete dry dock at the Charleston, S. C., navy yard to the New York Continental Jewell Filtration Company.

Vertical Car Borer.

The machine shown here embodies all the newest improvements to enable it to meet the particular requirements for heavy boring in wood in car shops and other places where large timbers are worked. It was patented Feb. 6, 1900, and is known as No. 5. The table is made in any desired length with rack and pinion feed under control of the operator and the



necessary stops and connections for making fine adjustments are also provided. Material up to 14 in. square can be bored, the spindles having a travel of 13 in. and the end frames a vertical movement of 8 in. The outside spindles have an angular adjustment of 45 degrees inside and 60 degrees outside with a locking device to hold them at any angle. The J. A. Fay & Egan Co., Cincinnati, Ohio, are the makers.

Grant Locomotive Works Sold.

The National Malleable Castings Co. has bought the Grant Locomotive Works in Chicago from the Electric Vehicle Co., for \$150,000, and it is said the plant will be used by a malleable consolidation now forming.

Locomotives for the Iowa Central.

We are in receipt of description and drawings of some recent consolidation engines built for the Iowa Central Railroad, from designs by Mr. G. V. Brooke, former superintendent of motive power of that road. The engines were built by the American Locomotive Company at their Schenectady Works. These engines are provided with slide valves and the second and third pairs of drivers have blind tires. The cylinders are 22

in. x 26 in., from which can be obtained a maximum tractive effort of 38,900 lbs. on a dry rail. The total weight is 170,000 lbs., with 151,500 lbs. on drivers. The total heating surface is 2,466 sq. ft. The grate area is 34.5 sq. ft., and the fire-box has a brick arch supported on water tubes.

Iron and Steel Situation.

Inadequate supplies of fuel caused further banking of furnaces, but the effect of a decreased output of domestic pig iron has been partially neutralized by larger arrivals from abroad. Practically no price can be named for immediate delivery of home iron, and there is no disposition to make concessions on distant contracts owing to the abnormal coke situation. Fortunately there has been little interruption at finishing mills, and the output of rails, structural material and kindred lines is well maintained. Consumers not only find difficulty in securing steel from the mills, but encounter a further delay on the railroads. Orders come forward freely for the heavier lines, numerous contracts being offered for rails for next year's delivery, and the plans for buildings and bridges keep a lot of business in sight in beams, channels, and angles. Plates for ship yards are also sought freely, prices tending upward on tank steel. Higher freight rates have checked imports of finished steel.—*Dun's Review*.

A Hydraulic Dredge from a Transport.

On the recommendation of Brig. Gen. Gillespie, Chief of Engineers U. S. Army, the Army transport "Grant" will be converted into a hydraulic dredge at San Francisco and used in the improvement of the mouth of the Columbia River, which is to cost \$2,000,000. The vessel is to be ready for work May 1 next.

Interlocking.

The Railroad Commission of Texas has approved the interlocking plant which the Southern Pacific has put in at the crossings of that road with the San Antonio & Aransas Pass at Flatonia and San Antonio. The Texas & New Orleans has submitted plans to the commission for interlocking at the crossings of that company with the International & Great Northern, the Houston, East & West Texas and the Gulf, Colorado & Santa Fe. These crossings are near together, at Houston, and will probably be operated from one cabin.

A newspaper account of improvements being made on the Chicago & Alton, with which the reader is already familiar, says that plans have been made for seven more interlocking plants and for 65 additional electric semaphore block signals.

The Taylor Signal Company has begun work on the installation of an electric interlocking plant at the Mississippi drawbridge of the Atchison, Topeka & Santa Fe at Fort Madison, Iowa. A dynamo and gasoline engine will be placed in the tower on the bridge for furnishing the power.

The Block System on the Chicago Great Western.

It is reported that the Chicago Great Western has decided to establish the block system between Chicago and Sycamore, 52 miles.

Standard Steel Car Company.

A party of 40, including railroad officers, recently inspected the new plant of the Standard Steel Car Co. at Butler, Pa. It covers 55 acres under roof, and in no building except the power house proper is steam used, all power being either electrical, hydraulic or compressed air. Work on the foundations was begun on April 14 and on Aug. 31 the first completed car was turned out. The main building is a steel and iron structure, 1,634 ft. long and varying in width from 240 to 500 ft. At the south end are the steel yards and the storage rooms for axles, car wheels, castings, etc. The paint shop and the wooden car department parallel the main building on either side. The company has many orders on hand from a number of large roads.

National Machine Tool Builders' Association.

The National Machine Tool Builders' Association, which was preliminarily organized in New York last May, held its first annual convention at Cleveland, Oct. 14 and 15. The object of the association is to promote the interests of the machine tool manufacturers in the direction of good fellowship and the liberal discussion of subjects pertaining to the manufacture of machine tools. The officers are as follows: Joseph Flather, Nashua, N. H., President; William Lodge, Cincinnati, Ohio, First Vice-President; W. P. Davis, Rochester, N. Y., Second Vice-President; Enoch Earle, Worcester, Mass., Treasurer, and P. E. Montanus, Springfield, Ohio, Secretary.

THE SCRAP HEAP.

Notes.

On Oct. 16 the 20-hour train of the Pennsylvania road for Chicago left Pittsburgh about 1 hour and 20 minutes late, but made up the whole of the time before it reached Chicago.

A press despatch from Pittsburgh, Oct. 19, says that the Western Union Telegraph Company has begun suit in the United States Court against the Pennsylvania Railroad to restrain it from depriving the Western Union of the right, which it has long held, to maintain and operate a telegraph line along the railroad.

There will be no general fall inspection of the Pennsylvania Railroad's lines this year. Heretofore several special trains carrying general and division officers have been run all over the system. This took up a great deal

of time, and it is frankly explained that this year the officers are too busy to make the trip. The value of the gathering was largely social and personal, and in the present pressure of traffic social interests must be laid aside. Inspections by a committee chosen for that purpose will be made as heretofore. One of these was begun last Tuesday. It is in charge of Joseph T. Richards, Engineer of Maintenance of Way. His committee is composed of Victor Wierman, J. B. Baker, Jr., C. T. Dabney and L. W. Allibone.

The Crops.

The harvests are pretty well over and the result is a bountiful yield of all grain. While the yield of wheat is not as large as last year it is above the average. It is estimated by the New York Produce Exchange that the results will be, in comparison with 1901, about as follows: Wheat, 620,895,000 bushels as against 748,460,268 in 1901; corn, 2,352,776,000 against 1,522,519,891 bushels last year; oats, 988,652,000 against 736,805,724; rye, 33,626,000 against 30,444,830; barley, 135,164,000 against 109,932,924; buckwheat, 14,329,000 against 15,125,039 bushels in 1901. Last year the falling off in our domestic exports was largely in breadstuffs caused by our short crop of corn.

The Direct Losses From the Strike.

A former mine superintendent in the Hazleton region, who is now acting as auditor for several large coal companies, was asked his opinion regarding several widely circulated estimates of losses from the strike. These tables estimate the total losses at from \$112,000,000 to \$150,000,000. He pronounced these figures gross exaggerations and made the following estimate:

Loss to R. R. companies in freight.....	\$14,000,000
Loss to anthracite operators from unusual sales of bituminous coal.....	6,000,000
Cost of coal and iron police force.....	1,000,000
Loss to strikers in wages.....	4,410,000
Damage to mines.....	800,000
Total.....	\$26,210,000

Some estimates have placed the loss in miners' wages as high as \$30,000,000. The expert explains his estimate by saying that the men work on an average but 190 days a year. From now on they will work practically full time, so that within the year their loss will be less than 35 days' work. The estimated losses to business men he also brands as absurd, saying that there has been little real complaint among the merchants in the anthracite field. Many of them have large outstanding accounts, but a majority of them are perfectly good.—*Wall Street Journal*.

Tramway Competition in England.

The following paragraph is from the latest half-yearly report of the Lancashire & Yorkshire Railway: The total number of passengers carried is 29,329,766, a decrease of 314,822, or 1.06 per cent.—not so large a decrease as last half-year, though still considerable—due to the effect of Tramway competition. In the first-class passengers there is a decrease of 16,085, or 3.59 per cent., and in money a decrease of £1,910, or 6.37 per cent. In the second-class there is an increase of 117,147, or 5.68 per cent., and in money an increase of £4,459, or 5.32 per cent. In the third class there is a decrease of 415,884, or 1.53 per cent., and in money of £10,384, or 1.49 per cent.

Many of the British companies are suffering keenly from the competition of the electric lines. The Glasgow & South-Western has given notice of intention to discontinue its suburban trains in and out of St. Enoch's station, Glasgow.

Lectures on Railroad Economics and Statistics.

We are pleased to draw attention to a course of lectures at the London School of Economics and Political Science by Mr. W. M. Acworth, M.A., on "Railway Statistics of England and Foreign Countries Comparatively Treated," which will start on Wednesday, Nov. 5. After Christmas a course on "The Economic Factors in Railway Administration" will be given by Professor Hewins. It is gratifying to notice the increased attention that is being given to these subjects. Mr. Acworth has devoted special study to his subject, and speaks with the authority of an expert, and both courses will, without doubt, be of great value.—*The Statist*.

A Trolley Trip at the Street Railroad Convention.

During the Convention of the American Street Railway Association at Detroit, the Crocker-Wheeler Company gave a trolley party for the delegates and their visitors. The trip was over the line of the Flint Division of the Detroit United Railway to the power house at Rochester, 28 miles from the city. This plant furnishes power for the entire division, nearly 75 miles of track, and includes a 400 k.w. generator, two 200 k.w. units and a Booster Set, connected in series with the line, capable of giving 150 volts pressure and 400 amperes. This enables the line voltage to be raised to 800 volts during time of heavy load. All the foregoing apparatus is of Crocker-Wheeler make. In addition, there is a rotary converter with transformers, raising one feeder pressure to 11,000 volts, which, transmitted to the Flint end of the line, is reduced at a sub-station to proper voltage direct current. The plant is very heavily loaded, the generators frequently carrying overloads of 100 per cent, and often being compelled to stand for a considerable length of time overloads as high as 75 per cent. The plant is an interesting one in showing conditions encountered in long distance interurban work, and the methods at present in use for meeting these requirements.

LOCOMOTIVE BUILDING.

The Southern has ordered three locomotives from the Baldwin Works.

The Ann Arbor has ordered two locomotives from the Baldwin Works.

The St. Louis Southwestern is having six locomotives built at the Rogers Works.

The Choctaw, Oklahoma & Gulf is having two locomotives built at the Baldwin Works.

The Iowa & St. Louis has ordered two 40-ton moguls from F. M. Hicks, rebuilt by the Hicks Locomotive & Car Works.

The Burlington, Cedar Rapids & Northern has ordered five locomotives from the Brooks Works of the American Locomotive Co.

The Chicago, Indiana & Eastern has bought two en-

gines from F. M. Hicks, rebuilt by the Hicks Locomotive & Car Works.

F. M. Hicks, of the Hicks Locomotive & Car Works, has received orders for four locomotives from miscellaneous parties since our last report.

The Sydney & Louisburg, Sydney, N. S., according to local press reports, is in the market for two consolidation locomotives, to weigh about 150,000 lbs. on drivers.

The Pennsylvania order for locomotives with the Baldwin Works for 1903 delivery now totals 350. The original order was 200, and orders for 50 and 100 respectively have since been placed. The classes will be determined later.

The Chicago & Alton, as reported in our issue of Oct. 17, has ordered two simple "Pacific" type locomotives from the Baldwin Locomotive Works. One of these engines will weigh 230,000 lbs., with 144,000 lbs. on the drivers, 22 x 28 in. cylinders, and 80 in. drivers. The other engine will weigh 226,000 lbs., with 142,000 lbs. on the drivers, 22 x 28 in. cylinders, and 73 in. drivers. Both engines will have straight radial stayed boilers, with a working steam pressure of 220 lbs., total heating surface of 4,064 sq. ft.; 330 tubes; 2 1/4 in. outside diameter, 20 ft. long; fire-box of Otis steel 108 in. long and 72 1/2 in. wide; grate area, 54 sq. ft.; tank capacity, 8,400 gallons of water and nine tons of coal. The special equipment will include: Otis steel axles; Keasbey & Mattison boiler lagging; National-Hollow brake-beams; Streeter steel brake-shoes; Tower couplers, with Westinghouse friction draft gear; Pyle-National electric headlights; Ohio injectors; U. S. Metallic piston and valve rod packings; Leach sanding devices; Nathan triple sight-feed lubricators; steel tire truck wheels, with wrought iron centers; steel tire tender wheels, with cast-iron centers. Other specialties are: Lindstrom Syphon device on tenders; Christy head and shoe on tenders; Chicago & Alton standard signal lamp brackets; fire-box to have two doors.

The Chicago, Milwaukee & St. Paul order for nine Atlantic type and 17 ten-wheel freight locomotives, ordered from the Baldwin Works for July, 1903, delivery, is as follows: The Atlantic type engines will be compound, weighing on drivers 80,000 lbs., total weight 148,000 lbs.; cylinders, 13 and 22 x 26 in.; diameter of drivers, 78 in.; straight top boilers, with working steam pressure of 200 lbs., and 262 iron tubes of No. 11 wire gage, length of tubes, 15 ft., outside diameter 2 in.; fire-boxes of carbon acid steel, 103 in. long and 42 in. wide; tank capacity for water, 7,000 gal.; coal capacity, 10 tons. Special equipment includes Hein couplers.

The 10-wheel engines will also be compound, weighing 126,500 lbs. on drivers; total weight, 176,000 lbs.; cylinders, 15 and 25 x 28 in.; diameter of drivers, 62 in.; wagon top boilers, with working steam pressure of 200 lbs., and 350 iron tubes 15 ft. long and 2 in. outside diameter; fire-boxes of carbon acid steel, 101 in. long and 66 in. wide; tank capacity for water, 7,000 gal.; coal capacity, 10 tons. Special equipment includes Munton couplers. The special equipment for both classes of engines also include Westinghouse air-brakes, main axles, Coffin Process; front and back, open-hearth; Ohio injectors, Miller piston rod and valve rod packings, Richardson safety valves, Leach sanding devices, Detroit sight feed lubricators, McKee-Fuller truck wheel tires, C. M. & St. P. cast-iron tender wheel tires, 56-in. cast-steel wheel centers and Western Valve Company's blow-off cock.

The Wabash order for 50 locomotives, reported in our issue of Sept. 5, calls for 32 compound moguls and six simple six-wheel switching engines ordered from the Baldwin Locomotive Works, and 12 simple "Atlantic" type engines from the Cooke Works of the American Locomotive Co. The compound engines will weigh 150,000 lbs., with 130,000 lbs. on the drivers, and have 20 1/2 and 32 1/2 x 28 in. cylinders, 63 in. drivers, extended wagon top boilers, with a working steam pressure of 200 lbs., and heating surface of 1,906.9 sq. ft.; 290 iron tubes, 2 in. in diameter, and 11 ft. 4 1/2 in. long; fire-box of carbon steel 114 1/2 in. long and 42 3/4 in. wide; grate area, 33.25 sq. ft.; tank capacity, 6,000 gallons of water and 10 tons of coal. The special equipment will include: Westinghouse American air-brakes, Wabash bell ringers, Franklin Mfg. Co.'s boiler lagging, Sterlingworth brake-beams, Wabash brake-shoes, Gould couplers, Wabash headlights, Ohio injectors, U. S. Bronze journal bearings, Wabash piston and valve rod packings, Ashton safety valves, Leach sanding devices, Chicago sight-feed lubricators, Ashton steam gages, Standard tires and cast steel wheel centers.

The switching engines will weigh 125,000 lbs., and have 19 x 28 in. cylinders, 57 in. drivers; straight boiler, with a working steam pressure of 190 lbs.; 300 iron tubes, 2 in. in diameter; fire-box of carbon steel 102 in. long and 39 1/2 in. wide; grate area, 28.15 sq. ft.; tank capacity, 4,500 gallons of water and six tons of coal. The special equipment will include: Westinghouse American air-brakes, Wabash bell ringers, Franklin Mfg. Co.'s boiler lagging, Sterlingworth brake-beams, Wabash brake-shoes, Gould couplers, Wabash headlights, Ohio injectors, U. S. Bronze journal bearings, Wabash piston and valve rod packings, Ashton safety valves, Leach sanding devices, Chicago sight-feed lubricators, Ashton steam gages, Standard tires and cast steel wheel centers.

The Atlantic engines will weigh 170,000 lbs., with 90,000 lbs. on the drivers, and have 20 x 28 in. cylinders, 83 in. drivers; extended wagon top boilers, with a working steam pressure of 220 lbs., and heating surface of 2,800 sq. ft.; 300 iron tubes, 2 in. in diameter, and 16 ft. long; fire-box of carbon steel 102 in. long and 66 in. wide; grate area, 46.75 sq. ft.; tank capacity, 6,000 gallons of water and 10 tons of coal. The special equipment will include: Westinghouse American air-brakes, Wabash bell ringers, Franklin Mfg. Co.'s boiler lagging, Sterlingworth brake-beams, Wabash brake-shoes, Gould couplers, Wabash headlights, Ohio injectors, U. S. Bronze journal bearings, Wabash piston and valve rod packings, Ashton safety valves, Leach sanding devices, Chicago sight-feed lubricators, Crosby steam gages, Gold steam heat equipment, Midvale driving wheel tires, McKee-Fuller truck and tender wheels and cast steel wheel centers.

CAR BUILDING.

The New York, Ontario & Western is in the market for six coaches.

The Canadian Pacific is asking prices on 20 first-class coaches.

The Manhattan Elevated has ordered 60 cars from the Wason Mfg. Co.

The Long Island has ordered 140 gondolas from the American Car & Foundry Co.

Wickwire Bros. have ordered 10 tank cars from the American Car & Foundry Co.

The Mobile, Jackson & Kansas City has ordered four coaches from the Harlan & Hollingsworth Co.

The Chicago, Milwaukee & St. Paul is considering the purchase of coaches, sleeping and dining cars.

The Chicago, Indianapolis & Louisville has ordered 200 gondolas from the American Car & Foundry Co.

The International & Great Northern denies the report that it is in the market for new equipment at the present time.

The Detroit & Mackinac has ordered from F. M. Hicks 100 box cars rebuilt by the Hicks Locomotive & Car Works.

The Philadelphia & Reading, in addition to the order reported in our issue of Oct. 17, is in the market for about 50 coaches.

The New York, New Haven & Hartford is reported to have bought 100 flat cars of 80,000 lbs. capacity from the Rutland and to have leased others.

The Central of New Jersey has placed an order for coaches with the Harlan & Hollingsworth Co. Further details are not available at the present time.

The Norfolk & Western is reported to have ordered 25 coaches from the Harlan & Hollingsworth Co., in addition to the order reported in our issue of June 6.

The Minneapolis, St. Paul & Sault Ste. Marie has given the order for 22 coaches on which it was reported figuring in our issue of Oct. 10, to the Barney & Smith Co.

The St. Louis Southwestern writes that the order for 25 coaches, for which inquiry was reported made in our issue of Oct. 10, will probably not be placed until next year.

The Wabash, according to local press reports, has ordered 1,000 steel cars from the American Car & Foundry Co. for July, 1903, delivery. This report has not as yet been verified.

The Illinois Central, as reported in our issue of Oct. 17, has ordered 1,000 box cars of 40 tons capacity from the American Car & Foundry Co. The cars will weigh 37,500 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The special equipment includes: Steel or iron axles; Common Sense bolsters; Westinghouse air-brakes; M. C. B. Hewitt brasses; Security door fastenings and doors; Gould draft rigging; M. C. B. malleable iron journal boxes and lids; Sherwin-Williams paint; Chicago roofs; American Steel Spring Co.'s springs and Kindl trucks.

The Seaboard Air Line, as reported in our issue of Oct. 17, is in the market for 1,000 box cars. These cars are to be of 60,000 lbs. capacity; weight of car, 31,000 lbs.; length inside, 36 ft.; width inside, 8 ft. 6 in.; height inside, 7 ft. 6 in.; to be built of wood with wooden underframes. Special equipment includes steel axles, 6-in. I-beam body bolsters, 9-in. I-beam truck bolsters, solid I-pattern brake-beams, hard cast-iron brake-shoes, Westinghouse trucks, Ajax brasses, Tower couplers, Dayton door fastenings and draft rigging, malleable iron journal boxes and journal box lids, metal roofs, S. A. L. standard coil springs, arch Diamond trucks, and 33-in. wheels.

The Colorado & Southern, as reported in our issue of Oct. 17, has ordered 250 40-ton Ingoldsby dump coal cars, for January, 1903, delivery; 150 40-ton steel Ingoldsby coke cars, for April, 1903, delivery; and 150 30-ton box cars, for January, 1903, delivery, from the American Car & Foundry Co. The coal cars will weigh 36,000 lbs., and the coke cars will weigh 39,000 lbs. The special equipment for both will include: Simplex bolsters; Sterlingsworth brake-beams; Westinghouse air-brakes; Kelso couplers; Miner tandem draft rigging; Harrison dust guards; McCord journal boxes; Devoe & Raynolds paint; French springs; Simplex trucks and American Car & Foundry Co.'s wheels. The special equipment for the box cars will include: Player bolsters; Westinghouse air-brakes; Tower couplers; Miner tandem draft rigging; Harrison dust guards; McCord journal boxes; Devoe & Raynolds paint; French springs; Player trucks and American Car & Foundry Co.'s wheels.

The Duluth, Missabe & Northern, as reported in our issue of Oct. 10, has ordered 350 ore cars from the Pressed Steel Car Co. for March, 1903, delivery, and 50 ore cars from the American Car & Foundry Co., for March, 1903, delivery. The Pressed Steel cars will be of 100,000 lbs. capacity; weight of car, 33,000 lbs.; length, 24 ft.; width, 8 ft. 6 in.; height, 9 ft. The American Car & Foundry cars will have precisely similar dimensions, and will be built of steel throughout. Special equipment for both classes of cars includes open-ear steel axles, cast-iron brake-shoes, Westinghouse brakes, Standard brasses, Chicago M. C. B. couplers, Westinghouse friction draft rigging, McCord journal boxes and journal box lids, Standard coil pattern springs and cast-iron wheels. The American Car & Foundry cars will have cast steel bolsters and Player cast steel trucks. The Pressed Steel cars will have pressed steel bolsters and truck.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered seven day coaches, five baggage, four sleeping and one dining car from Barney & Smith, for April, 1903, delivery. The coaches will be 64 ft. 6 in. long, 9 ft. 10½ in. wide and 6 ft. 9 in. high from top of sill to bottom of plate, with wooden underframes. The special equipment includes: Westinghouse air-brakes; Barney & Smith brasses; Washburn flexible head couplers; Burrows curtain fixtures; Pantasote curtains; Gold duplex heating system; McCord journal boxes and lids; standard steel platforms; Barney & Smith seats and six-wheel trucks; Pullman wide vestibules and steel tired wheels (Co.'s National No. 6). The baggage cars will be 70 ft. long over sills, 9 ft. 10½ in. wide and 6 ft. 7 in. high from top of sill to bottom of plate, with wooden underframes. The special equipment includes: Westinghouse air-brakes; Barney & Smith brasses; Washburn flexible head couplers; Gold duplex heating system; McCord journal boxes and lids; standard steel platforms; Barney & Smith six-wheel trucks and steel tired wheels (Co.'s National No. 6). The sleeping and dining car will be duplicates of those received last spring.

BRIDGE BUILDING.

ADRIAN, MICH.—The question of building a bridge over the Lake Shore at Tecumseh street was again presented to the Councils last week. This has been up several times.

BEEVILLE, TEXAS.—The County Court recently held a special session to take necessary steps to have the bridges and roads rebuilt that were destroyed last spring.

CHICAGO, ILL.—The contract for building the super-

structure of the bridge over the river at Division street has been let to Roemheld & Gallery at \$160,000.

CLAREMONT, N. H.—We are told that there is talk of building a bridge over the Connecticut River between this city and Weathersfield, but nothing has been decided. If built, it will be about 600 ft. long.

CLEVELAND, O.—City Engineer Carter has just finished the preliminary plans for the new Superior street viaduct, which, it is said, will cost about \$750,000.

CRAWFORDSVILLE, IND.—Bids are wanted, Nov. 3, by the Board of Commissioners of Montgomery County, for the substructure of a bridge over North Fork of Coal Creek. James A. Harding, Surveyor.

DE MOTTE, IND.—Wm. C. Babcock, Auditor for Jasper County, writes that bids are wanted Nov. 3 for a steel bridge over a large ditch.

DE QUEEN, ARK.—The county has voted to have the County Commissioners spend \$5,000 for a new bridge across Rolling Fork River.

ELIZABETH CITY, N. C.—Bids are wanted at once, with plans, by Dr. A. L. Pendleton, for a bridge over Point-dexter Creek.

FAIRBURY, NEB.—Bids will be received at the office of W. S. Diller, County Clerk, until Dec. 4, for repairing all county bridges and building any new ones wanted during the year beginning Jan. 1, 1903.

FULLERTON, NEB.—Bids are wanted until Dec. 1 for a lot of bridge material. Address the Board of Supervisors of Nance County. D. Stephenson, County Clerk.

GREAT BEND, KAN.—F. M. Tutschig, County Clerk, wants bids on Nov. 8 for a bridge over Blood Creek.

HARRISBURG, PA.—T. L. Eyre, Superintendent of Public Grounds and Buildings, writes that he is having plans made and will let contracts soon for additional bridges in various counties to replace structures destroyed by freshets. Some of the bridges will cost between \$5,000 and \$10,000.

HATFIELD, MASS.—The town has voted to give about \$3,000 toward the new bridge near North Hatfield. The work will be done in connection with the electric railroad.

JASPER, ALA.—The Commissioners of Walker County will receive bids, Nov. 5, at Jasper, for a steel bridge of large dimensions. J. W. Shepperd is Probate Judge.

KANSAS CITY, MO.—The Board of Public Works has ordered the City Engineer to prepare an ordinance for a new bridge to replace that across Brush Creek on the Wornedell road. The plans, which are already made, provide for a concrete-steel structure.

LA CROSSE, WIS.—The Chicago, Milwaukee & St. Paul is said to have notified the Board of Public Works of this city that it will build a new bridge over the tracks on Rose street. This work will probably not be done this year.

MARION, IND.—The contract for the steel bridge to be built over Missisnewa River between Marion and North Marion for the Big Four and the Toledo, St. Louis & Western, has been let to the King Bridge Co., at \$25,000. It will be a single-track bridge, 283 ft. long, composed of deck-plate girders.

MAYFIELD, WASH.—Bids are wanted Nov. 6 by the County Auditor at Chehalis for a bridge over Cowlitz River. The bids are to cover all-steel and combination bridges.

MEMPHIS, TENN.—Officers of the railroad companies interested in the new bridge to be built at Dunlap street have recently met the city officers to devise some plan to build. The total cost will be \$10,000. The roads interested are the Union Ry., or the Belt Line, the Frisco and the Southern.

MINNEAPOLIS, MINN.—It is said that the railroad committee of the City Council has ordered the Northern Pacific R. R. to build a bridge over its tracks on Harvard street; also at Como avenue.

NEW CASTLE, PA.—Local reports say that a meeting was recently held between Councils, County Commissioners and representatives of the steam and electric railroads to consider the advisability of building the proposed Shenango viaduct from the foot of East Long avenue to North Liberty. Such a bridge will be over 3,000 ft. long. Surveys have been ordered made.

OSKALOOSA, IOWA.—Bids are wanted, Nov. 12, for two steel bridges, 93 ft. and 110 ft. Address the County Auditor of Mahaska County.

PAULING, OHIO.—The Board of County Commissioners want bids until Nov. 14 for three bridges. One will be over the Maumee River, north of Antwerp, to be of three spans, each span being 129 ft. 6 in.; another bridge is over Little Auglaize River, near Mandale, to be one span, low-truss, 65 ft. long. Another will cross Flat Rock Creek near its mouth and will consist of one span, single-track, high truss, 105 ft. long, pin center, with 16-ft. roadway. J. B. Weidle, member of the Board. Oliver Morrow, County Surveyor.

PEORIA, ILL.—The matter of a subway on Sanger street is now being considered by the officers of the Peoria & Pekin and the Chicago, Burlington & Quincy. The question of a new city bridge at the foot of Bridge street has been talked of, but nothing definite has been decided. H. E. Beasley, City Engineer.

PITTSBURGH, PA.—A local report is that the electric railroad company which will use the Mount Washington tunnel will soon let a contract for three steel viaducts, the total cost to be \$125,000.

PITTSBORO, ALA.—The Commissioners of Russell County have decided hereafter to only build steel bridges and contemplate in the near future to build the first bridge of that kind near Pittsboro.

READING, PA.—The County Court has approved the proposition for building about eight bridges in the county at a cost of \$20,000. Some of the contracts are let and others will be let soon.

RICHMOND, VA.—An ordinance is before the City Council to require the Chesapeake & Ohio to build a bridge over Eighth street where it is crossed by the tracks.

SANATOGA, PA.—For some years there has been talk of building a bridge over the Schuylkill River, in the vicinity of Sanatoga, in Montgomery County, to near Fricks Lock, Chester County. The cost would be about \$30,000, or \$15,000 for each county. The indications are that something will be done in the near future.

SAULT STE. MARIE, MICH.—Bollar & Hodge, New York, are making plans for a viaduct for the Algoma Central & Hudson Bay Ry., which will be 1,500 ft. long and 125 ft. high at the highest point.

SULLIVAN, IND.—The Commissioners of Sullivan County and of Vigo County, who are to build two bridges on the county line, have extended the date for receiving bids until 1 p. m., Nov. 7. The bridges are not very large structures.

TORONTO, ONT.—The City Engineer has recommended a new draw bridge over Keating's Channel.

UNIONVILLE, MO.—G. W. Dickson, Bridge Commissioner, will let contracts on Nov. 3 for five bridge building jobs.

VINCENNES, IND.—It is said plans have been made by Edward C. Faith for a bridge of three spans, each 140 ft., across White River.

WASHINGTON, D. C.—Col. Allen, the U. S. Engineer officer in charge of river and harbor work at Washington, is preparing the plans and specifications for the new highway bridge across the Potomac River above the new Pennsylvania Railroad bridge, and it is expected that proposals for the bridge will be asked within a few weeks.

WASHINGTON, IND.—It is said that plans have been made by Edward C. Faith for the proposed bridge over White River. It is to be of three spans, each 140 ft. long.

WELLAND, ONT.—The time for receiving tenders for the steel superstructure of Montrose Bridge, over the Welland River, in the County of Welland, has been postponed till October 29, at 12 noon. Information may be had from Geo. Ross, C. E., Welland, Ont. (Oct. 17, p. 803.)

WILMERDING, PA.—The Pittsburgh Railways Co. has let a contract to the McClintic-Marshall Construction Co., to build the steel viaduct 1,500 ft. long over the tracks of the Pennsylvania and over Turtle Creek.

Other Structures.

BALTIMORE, MD.—A company is being formed by Chas. T. Crain, President of the Farmers' & Merchants' National Bank; Howard Carlton, President of the South Baltimore Car Works; H. Crawford Black and others, to build a large plant in Baltimore to make steel castings for railroad cars and other purposes. It is said the new company will be capitalized at \$1,000,000.

The Baltimore & Ohio is asking bids on a big steamship pier to be built at Locust Point.

BIRMINGHAM, ALA.—The Garrett-Cromwell Engineering Co., of Cleveland, according to report, are making the plans for the plant to be built by the Alabama Steel & Wire Co. at Birmingham. It is also said that a number of contracts have been placed.

CANAL DOVER, OHIO.—The Standard Motive Power Co. is letting contracts for its large locomotive works at Canal Dover. There will be 15 buildings which, with equipment, it is said, will cost \$800,000.

CHESTER, PA.—The Seaboard Steel Casting Co. has decided to make enlargements and improvements to its foundry plant and it is said that this will involve the expenditure of a large sum of money.

CHICAGO, ILL.—The Lake Shore & Michigan Southern and the Rock Island roads have taken out permits for four additional stories to the new station at 136 to 154 Van Buren street. It is said the addition will cost \$370,000.

CLEVELAND, OHIO.—The Cleveland Steel Casting Co. has recently increased its capital stock by \$100,000 and will make additions which will increase the capacity about 150 per cent.

The Vulcanus Forging Co. will enlarge its plant. F. H. Kindl, for a number of years Structural Engineer of the Carnegie Steel Co., recently became President and General Manager of this company.

The Cleveland Stamping and Tool Co. has recently bought some buildings adjoining its plant and is installing new machinery.

The Cleveland Machine & Manufacturing Co. will also enlarge its factory.

Work has been begun on the new machine shop for the Snider-Hughes Co., to make pumping machinery.

It is said that plans are being made for a 14-story steel frame building for the use of the Lake Shore & Michigan Southern, and that work will be begun so as to have it finished in two years.

CONNELLSVILLE, PA.—The old Sligo mills on the Southside, Pittsburgh, which were built in 1825, are to be dismantled and rebuilt at Connelville. The old mills have a capacity of about 24,000 tons a year of bars, angles, sheets and specialties. The plant has 38 puddling furnaces, 12 heating furnaces, two hammers, two trains of rolls and other equipment. It is usually active the year round. A new company is being formed for the operation of the mills when moved to Connelville.

HUBBARD, OHIO.—The Andrews-Hitchcock Iron Co. has decided to double the capacity of its plant at Hubbard and has awarded contracts for the extension.

LUXORA, ALA.—The St. Louis, Memphis & Southeastern will build a roundhouse and repair shops here. Address E. F. Blomeyer, Vice-President, at Cape Girardeau, Mo.

NASHVILLE, TENN.—The Nashville Bridge & Construction Co., recently organized, will soon establish a large bridge material shop and forge in Nashville. The site is on the Cumberland River, opposite Broad street. The officers are: John D. Anderson, president; Watkins Crockett, vice-president; R. D. Goodlett, secretary and treasurer, and A. J. Dyer, general manager and engineer.

PERU, IND.—The Cincinnati, Richmond & Muncie R. R. has decided to locate its new shops in the city of Peru and it is said that the plans will be finished at once for the buildings, which will cost at least \$100,000.

PITTSBURGH, PA.—It is said that the Pittsburgh & Lake Erie contemplates building quite a number of warehouses at Twenty-second street, Southside. No details have been given out.

ST. LOUIS, MO.—The Treasury Department, Washington, D. C., has awarded the contract for the steel and structural work for the Government building at the Louisiana Purchase Exposition at St. Louis to the Penn Bridge Co., of Beaver Falls, Pa. The price is \$120,570, and the steel is to be delivered within 240 days.

The Terminal Association of St. Louis has begun condemnation proceedings to extend the union station at a cost of \$7,000,000. The main improvements will be the extension to the trainshed.

WEST POINT, N. Y.—The Secretary of War has approved the preliminary plans prepared by the Board of Army officers at West Point for the improvement of the Military Academy, which were first submitted to the Supervising Architect of the Treasury. The general plan being settled, the details can now be worked out, but building operations will not commence before next summer. On account of the reduction of the appropriation below the estimates the whole project had to be revised.

WHEELING, W. VA.—An officer of the Baltimore & Ohio is reported as saying that something will be done

soon in regard to the new passenger station in Wheeling. The company now has the matter under consideration.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

Canadian Society of Civil Engineers.

At the ordinary meeting on Thursday, Oct. 23, at 8 p.m., a paper by C. H. Rust, M. Can. Soc. C. E., on "Sewage Disposal" was read.

Railway Club of Pittsburgh.

A smoker and the first annual meeting of the club will be held Friday evening, Oct. 24, at 8 o'clock p.m., at the Hotel Henry. The club will be favored with addresses by Col. J. M. Schoonmaker, H. K. Porter, Geo. A. Post and others, and the election of officers will take place. This meeting will be informal.

Northwest Railway Club.

At the meeting held on Sept. 9, at the West Hotel, Minneapolis, discussion was continued on the topic, "The Best Form of Discipline for Engine and Trainmen," and brief papers were submitted by S. Shepard, J. E. Goodman and O. B. Johnson. Other topics discussed were: "The Future Engineer" and "Train Lighting."

Western Society of Engineers.

A meeting of the society was held in the society's rooms in Chicago, Wednesday, Oct. 22. Papers on "The Yazoo Delta of Mississippi and Construction of its Railroads" by Mr. J. W. Darling, M. W. S. E., and "Water Waste in Cities and its Detection," by Mr. E. S. Cole, M. W. S. E., were presented, both being illustrated by lantern slides.

Central Railway Club.

At the meeting on Sept. 12 discussion was continued on the report of High-Speed Brakes, and Mr. F. M. Nellis read his part of the report. Mr. L. R. Pomeroy, of New York, representative of the railroad department of the General Electric Co., will present a report at the November meeting on "The Advantages of Electricity Driven Railroad Shops," and which will be illustrated with diagrams.

Engineers' Club of St. Louis.

The 549th meeting of the Engineers' Club of St. Louis was held at the rooms of the club Oct. 15, at 8:25 p.m., Vice-President Van Ornum presiding. Present, 23 members and five visitors. The subject of the evening was a paper by Dr. A. P. Winston on "The Good and Evil of Trades Unions." The speaker discussed the different methods of regulating wages and the advantages and disadvantages of each system both to the workmen and their employers. Discussion followed by Messrs. Hermann, Moore, Bouton, Van Ornum, Reber, Wheeler, Bryan and Colby participated.

Railroad Commissioners of the Southern States.

Railroad commissioners from Arkansas, Alabama, Mississippi, Virginia and Texas met in convention at Hot Springs, Ark., Oct. 15 and 16. The meeting was presided over by Mr. Baptist, of Tennessee, and John H. Webb, of Mississippi, was Secretary. The meeting was addressed by Mr. Reagan, of Texas, who spoke of the functions and duties of railroad commissioners and of the great usefulness of railroads when properly managed and developed. A resolution was passed looking to the sending of a memorial to Congress in favor of the proposed law to increase the powers of the Interstate Commerce Commission. A resolution was also passed expressing, as the sense of the association, that each State ought to abolish by law all grade crossings, as far as practicable, and ought to require the use of interlocking and other safety devices where abolition is impossible.

New York Railroad Club.

At the meeting of the New York Railroad Club held on the 16th inst. two important changes were made effective, that should have a material bearing on the continued growth and prosperity of the club.

President Vreeland, as Chairman of the Committee on New Quarters, reported at length the exhaustive search made for suitable accommodations and the finding of but one place to meet the requirements of the club. That place being unavailable for the third Thursday evening of the month he suggested the advisability of change of meeting night of the club to the third Friday evening, which would as well be of greater convenience to out of town members. On the recommendation of the Executive Committee the club unanimously decided to make the necessary changes in the by-law of the organization, changing the regular meeting night to the third Friday evening of the month, excepting June, July and August. Having made this change the location at No. 154 West 57th street (in Carnegie Hall) was determined on as the future meeting place of the club.

In the technical discussion following the business section of the meeting a paper was presented by Mr. R. L. Calkins, Freight Claim Agent of the New York Central & Hudson River Railroad, on "Railroad Freight Claims." An abstract appears on another page.

The Engineering and Maintenance of Way Association.

A meeting of the Committee on Ballasting was held at the Union Depot, St. Louis, Mo., on the 10th inst., there being present the Chairman, Vice-Chairman Molitor, S. B. Fisher and W. B. Storey, Jr. The subject as to "What Constitutes Ballasted Track" was discussed and the following definition drafted: "Ballasted track is track held in line with the surface by selected material placed above the roadbed in which cross-ties are imbedded. The object of such material being to obtain a solid and uniform bearing for the cross-ties to distribute the applied load and to provide suitable drainage." The question as to what material could be used for ballast was also discussed, and it was agreed that the materials named in the last annual report, namely, broken stone, gravel, burnt clay, partially disintegrated rock, chatts and cinders could be used. A rough draft was formulated for specifications for stone. It was decided that no specifications could be drawn up for gravel, as in each case any particular deposit would have to be passed upon as to whether it was of practicable value. The question of cinder ballast was discussed, and it was found that the experience of the members present has been that they have had very poor success with engine cinders. The question arises as to whether the increased wheel loading has placed to great a burden on cinders. It was the desire of the members of the committee present that each member formulate specifications for each of the various kinds of ballast promptly and send to the chairman.

PERSONAL.

—Mr. C. F. Giles, who was recently transferred to Louisville as Master Mechanic of the Louisville & Nashville, began his railroad service with the Baltimore & Ohio at Wheeling, W. Va., in February, 1873. In November of that year he was transferred to the Grafton shop. Mr. Giles remained in the service of this company until 1879, when he resigned to go with the Texas Pacific as a machinist. He was a short time with the Pennsylvania Railroad, and was during the year 1881-1882 a machinist on the Louisville & Nashville. From then until his recent promotion he has held various positions with this company.

—Mr. F. G. Sherman, who has just succeeded Mr. Adams as Superintendent of Telegraph of the Central R. R. of New Jersey, was born in 1855. In 1873 he entered the telegraph office of the Chicago & Iowa, now a part of the Chicago Division of the Chicago, Burlington & Quincy, and six months later entered the service of the last named road as an operator and worked at various stations until 1884, when he entered the despatcher's office at Aurora, Ill. In 1899 he resigned to go with the Reading, but left that company on May 1 last to accept the position of Assistant Trainmaster of the Central R. R. of New Jersey.

—Mr. C. E. Fuller, the new Assistant Mechanical Superintendent of the Erie Railroad, is a native of Indiana, having been born in Terre Haute in 1862. After completing a mechanical course he entered the service of the Terre Haute & Indianapolis as an apprentice. In 1889 he left this company and went with the Erie as General Foreman at Hornellsville, where he remained until 1890. In February of that year he was made Master Mechanic of the New York Division, and the following seven years was Superintendent of Motive Power of the Central Vermont. In January, 1900, he returned to the Erie as Master Mechanic at Susquehanna, from which position he has just been promoted as above.

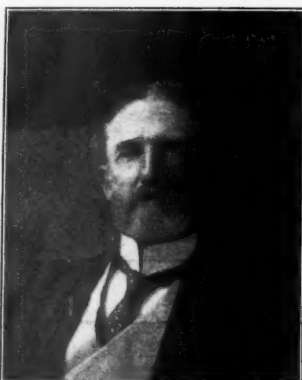
—Mr. E. H. DeGroot, Jr., who on the first of October became Superintendent of the St. Louis and St. Elmo Divisions of the Chicago & Eastern Illinois, was born at Galesburg, Ill., March 22, 1871. In 1886 he entered the general freight office of the Chicago, Burlington & Quincy as an office boy, but resigned the following year to become a clerk in the general freight office of the Chicago & Eastern Illinois at Chicago. In 1889 he again took service with the Chicago, Burlington & Quincy and served continuously in train and yard service, Chicago and Galesburg Divisions, until November, 1898, when he returned to the Chicago & Eastern Illinois as Trainmaster, which position he held until his recent promotion as Superintendent.

—Mr. C. H. Morrison, Signal Engineer of the Erie Railroad at Jersey City, has been a member of the Railway Signaling Club since its organization. Mr. Morrison was born in Dayton, Ohio, in 1870. In 1892 he took the position of draftsman in the signal department of the Chicago, Milwaukee & St. Paul and was promoted to be signal inspector the following year, having charge of the electrical signals and drafting. In April, 1901, he left that company to take the position of Assistant Signal Engineer with the Railroad Supply Company, and remained with them until July, this year, when he became Special Inspector on the Chicago, Rock Island & Pacific, where he remained until taking his present position with the Erie.

—Mr. H. W. Battin, Superintendent of the Northern Wisconsin Division of the Chicago & North Western, was born in 1861. Immediately after graduating from Cornell University (Civil Engineer) in 1881, he took service with the Chicago & North Western as Rodman on location and construction of extensions of lines in South Dakota. He continued as Assistant Engineer in this work and in Maintenance of Way on the Minnesota Division until 1885, when he assumed charge of the Western Sub-Division as roadmaster. Three years later he was made Division Engineer, and in 1896 became Engineer of second track in charge of work between Baraboo and Madison. In 1898 he became Assistant Superintendent of the Madison Division, and in 1902 assumed the Superintendency of the Northern Wisconsin Division.

—Mr. William P. Atkin died on Monday of this week at his home in Montclair, N. J., after a long illness. He was about 65 years old. Mr. Atkin was a printer by trade, and began business for himself about 1878. From that time until his death he was a master printer in New York City, and for years had printed the *Railroad Gazette*, the *Engineering News*, the *Engineering & Mining Journal*, the *Engineering Record*, the *American Engineer & Railroad Journal*, and other technical and trade papers. For a long time he was printer of the *North American Review* and of the *Turf, Field & Farm*, and of several other well-known weekly papers. Mr. Atkin had those qualities of fairness, ability and integrity which won and kept the confidence of his customers and also of his workmen, with whom he was always in close sympathy. He made no great figure in the world, but he was a useful and estimable citizen.

—Mr. Robert Cumming Schenck, President of the Dayton Malleable Iron Company, of Dayton, whose death occurred in the Faxon Hospital, Utica, N. Y., at noon Oct. 15, had been connected with this company for more than twenty years. He was born in Franklin, Warren County, Ohio, in 1845, and was a graduate of the Miami University, class of 1864. In May, the same year, he served through the campaign in the mountains of West Virginia. In 1868 he formed a partnership with Mr. S. W. Davies in the lumber business, but retired from the firm two years later. He was a member of the American District Telegraph Com-



pany and for about two years was in the United States government service. In 1882 he became President of the Dayton Malleable Iron Company and remained actively at the head of this large corporation up to the time of his death. He was also connected with the National Cornice Works and was a director in many other companies. When Mr. Schenck took over the Dayton Malleable Iron Company, some twenty years ago, it was a very small concern, but by his energy and skill it has been

built up to its present standing. One of the railroad companies of which he was a director was the Cincinnati, Hamilton & Dayton Railway. At the meeting of this company held the day previous to Mr. Schenck's death he was re-elected a director. Mr. M. D. Woodford, President of this railroad, in a warm tribute expresses keen appreciation of his "noble nature, his high standards and his exemplary life." Mr. Schenck, says Mr. Woodford, was "the highest type of the gentleman. His sad death is felt as the loss of a devoted friend."

—Mr. Oliver W. Ruggles, who has been chosen President of the General Passenger Agents' Association, is



General Passenger Agent of the Michigan Central. Mr. Ruggles began his railroad service as an errand boy for the Ohio & Mississippi and was gradually promoted until he became clerk in the general passenger agent's office of the St. Louis, Iron Mountain & Southern and served through every grade up to General Passenger Agent. Upon the consolidation of that company with the Missouri Pacific he became Assistant General Passenger Agent of both lines and remained as such until December, 1881, when he was appointed General Passenger Agent of the Michigan Central.

ELECTIONS AND APPOINTMENTS.

Arkansas Western.—L. C. Torrence, Chief Engineer, with headquarters at Waldron, Ark., has resigned.

Atchison, Topoka & Santa Fe.—E. O. Faulkner, heretofore Purchasing Agent of the Kansas City Belt, has been appointed Assistant to the General Manager of the A., T. & S. F.

Atlanta, Knoxville & Northern.—J. H. Ellis, heretofore Assistant Secretary, has been elected Vice-President and General Manager, succeeding J. B. Newton, resigned.

Baltimore & Ohio.—W. R. Edwards has been appointed Assistant Engineer of Bridges and Buildings.

Canadian Northern.—D. B. Hanna has been elected Third Vice-President and Comptroller, with headquarters at Toronto, Ont.

E. A. James, heretofore Superintendent of Transportation of the Western Division of the Canadian Pacific, has been appointed General Superintendent of the C. N., succeeding Mr. Hanna.

Canadian Pacific.—M. H. Brown, heretofore Assistant General Freight Agent of the Ontario Division, has been appointed General Freight Agent. See Canadian Northern.

Colorado & Northwestern.—H. D. Milton has been appointed General Manager, succeeding C. B. Culbertson.

Colorado & Southern.—W. N. Schoff, Purchasing Agent, with headquarters at Denver, Colo., has resigned.

W. M. Bacon has been appointed Superintendent, with headquarters at Denver, Colo., succeeding J. A. Rasbach, resigned.

Colorado Midland.—B. H. Bryant, heretofore General Superintendent, has been appointed Chief Engineer and J. C. Vining, heretofore Trainmaster, becomes Superintendent of Transportation.

Detroit Southern.—H. E. Passmore has been appointed Superintendent of Motive Power and Equipment, with headquarters at Springfield, Ohio, succeeding E. M. Roberts.

Erie.—M. R. Coutant has been appointed Master Mechanic of the Delaware, Susquehanna, Jefferson and Tioga Divisions, with headquarters at Susquehanna, Pa., succeeding C. E. Fuller.

Illinois Central.—C. Vanderbilt has been elected a Director, succeeding J. D. W. Cutting.

Kansas City Southern.—J. E. Jarrett, heretofore General Foreman of Bridges and Buildings, has been appointed Superintendent, with headquarters at Texarkana, Tex., succeeding D. C. Bevard.

Kansas City, St. Joseph & Council Bluffs.—R. K. Smith, Assistant Superintendent, with headquarters at St. Joseph, Mo., has resigned. (See Missouri Pacific.)

Lake Erie, Alliance & Wheeling.—F. M. Mast has been appointed Superintendent of Motive Power and Car Equipment with headquarters at Alliance, Ohio. F. Gleich, heretofore Master Mechanic, has been assigned to other duties.

Lake Erie & Western.—F. T. Bowles has been appointed Superintendent, with headquarters at Muncie, Ind., succeeding Geo. Dyer.

Louisville & Nashville.—J. J. Sullivan has been appointed Master Mechanic, with headquarters at Decatur, Ala.

Marietta, Columbus & Cleveland.—D. I. Roberts, heretofore Vice-President of the Little Kanawha, has been elected President and General Manager of the M., C. & C. J. T. Blair has been elected Treasurer.

F. L. Alexander, Secretary and Auditor, has resigned.

Mexican International.—Wm. Hollis, heretofore Material Agent, has been appointed Purchasing Agent.

Missouri, Kansas & Texas.—D. A. Bowersock has been appointed General Foreman of Bridges and Buildings, with headquarters at Denison, Texas, succeeding A. J. Austin, resigned.

Missouri Pacific.—R. K. Smith, heretofore Assistant Superintendent of the Kansas City, St. Joseph & Council Bluffs, has been appointed Superintendent of the Missouri Division, succeeding W. T. Tyler. R. H. Dwyer has become Superintendent at Sedalia, Mo., succeeding I. H. Luke.

New York Central & Hudson River.—J. C. Irwin has been appointed Assistant to the General Superintendent, with headquarters at New York City.

Peter G. Ten Eyck has been appointed Engineer of Signals, succeeding Mr. Irwin. John Roberts becomes Supervisor of Signals of the Middle Division, with headquarters at Albany, N. Y., succeeding Mr. Ten Eyck. Thomas A. Lang has been appointed Engineer of Construction in charge of location and construction of new lines, Pennsylvania Division at Mahafey, Pa. D. Fairchild, who has been Acting Purchasing Agent, has been appointed Purchasing Agent.

Northern Pacific.—H. J. Horn, Jr., has been appointed Assistant General Superintendent, with headquarters at Livingston, Mont. Asst. General Superintendent A. E. Law has been placed in charge of the Idaho, Pacific and Seattle Division, and Assistant General Superintendent E. J. Pearson over the Lake Superior, Minnesota and Dakota Divisions. D. Doyle has been appointed Superintendent and R. M. McLeod Assistant Superintendent of the Montana Division.

Peoria & Pekin Terminal.—N. C. Draper, General Superintendent at Peoria, Ill., has resigned. G. W. Talbot, Traffic Manager, will assume the duties temporarily.

Pere Marquette.—F. H. Alfred, heretofore Assistant Engineer, has been appointed Chief Engineer, with headquarters at Detroit, Mich., succeeding G. H. Kimball, resigned.

St. Joseph & Grand Island.—F. C. Uhlman has been appointed Auditor, with headquarters at St. Joseph, Mo., succeeding H. W. Millman, resigned.

St. Louis Merchants Bridge Terminal.—W. C. Wilson, heretofore Master Mechanic, has been appointed General Foreman, with headquarters at Madison, Ill.

Virginia & Southwestern.—Henry K. McHarg has been elected President, succeeding Grant B. Schley.

Virginia-Carolina.—John Ingles has been appointed Superintendent, with headquarters at Abingdon, Va.

Wabash.—S. E. Cotter has been appointed Superintendent of the Eastern Division, with headquarters at Peru, Ind., succeeding E. A. Gould. R. J. Woods succeeds Mr. Cotter as Fuel Agent at St. Louis, Mo.

Weatherford, Mineral Wells & Northwestern.—G. J. Gould has been elected President, succeeding L. M. Fouts; L. F. Thorne, Vice-President, and J. W. Boot, Secretary and Treasurer. (See R. R. News column.)

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA ROADS.—Purchase of mill property at Andalusia, Ala., is reported to have been made by D. M. and R. M. Pierson, of Fitzgerald, Ga., who intend building 15 miles of railroad in connection with their property.

ASHLAND & WOOSTER.—Contract to build the projected extension from Ashland to Savannah, Ohio, has been let to W. E. Burk, of Akron. Surveys have also been made beyond Savannah to New London, seven miles further, and contracts for this section will be let at a later date. (Sept. 5, p. 695.)

BLACKSTONE-CHASE CITY.—Surveys are reported for a new line from Blackstone, in Nottoway County, Va., to Chase City, in Mecklenburg County, a distance of about 50 miles. About 13 miles have been surveyed already on the Blackstone end, and surveys are now being made on the Chase City end. If the road is built as projected it will afford an outlet for lumber and granite industries in Lunenburg County.

BUFFALO & SUSQUEHANNA.—Surveys have been made for a railroad from the present terminus at Sinnemahoning, Pa., to Du Bois, and thence southward about 10 miles to the coal lands, and maps have been filed in Cameron, Elk and Clearfield counties in which the extension will be situated. The projected distance is about 62 miles and it is expected to begin work before winter.

An extension 22 miles long from Hull, on the main line, to Cutler Summit, on the Wellsville branch, 22 miles south of Wellsville, is also contemplated. This cut-off will reduce the distance from the coal fields to Buffalo about 16 miles, besides improving grade and curvature. The extension from Wellsville to Buffalo, 80 miles, will be built by a corporation organized for the purpose in the interest of the railroad company. No special engineering difficulties are presented. The complete line of about 215 miles from the coal fields south of Du Bois to Buffalo will cross only two summits and those by relatively easy grades. A tract of about 50 acres of land has been acquired in Buffalo for terminal facilities adjoining the new plant of the Lackawanna Steel Co., and directly on the lake front. Adjoining the terminal lands about 50 acres additional have been secured by the Buffalo & Susquehanna Iron Co., which is affiliated in interest with the railroad, and a large blast furnace plant is being built on this site. It is expected that as soon as the railroad is opened to Buffalo some one million tons of coal, including that taken by the furnaces mentioned, will annually go over its lines. (Official. See also under Railroad News.)

CALIFORNIA ROADS.—Further particulars in regard to the line which the Diamond Match Co. proposes to build, indicate that the Supervisors of Butte County, Cal., granted a franchise for a line to connect with the Southern Pacific at Durham, 30 miles above Marysville, and run towards Cherokee Ditch, Little Butte Creek, Magnolia and the timber lands owned by the company. (Aug. 8, p. 631.)

CANADIAN PACIFIC.—Betterment of the Calgary & Edmonton, including general repairs, grade changes, etc., which will cost approximately \$100,000, has been begun by a large force. Work was to have been started some time ago, but was delayed by a disagreement between the Canadian Pacific and the owners of the property as to the terms on which it should be done.

CAPE GIRARDEAU INTERURBAN.—Articles of incorporation were filed in Missouri, Oct. 16, for the above company, which proposes to build from Cape Girardeau to Jackson, Mo., 18 miles. R. F. Walker, of St. Louis; James A. Matteson, of Cape Girardeau, and others, are the incorporators.

CARROLLTON SHORT LINE.—Work is reported in progress on the extension from Carrollton, Ala., to Bridgeville, in Pickens County, a distance of about 12 miles. The line is now worked between Carrollton and Reform, Ala., 10 miles. (Sept. 19, p. 733.)

CHICAGO, INDIANA & EASTERN.—This company has increased its capital stock from \$420,000 to \$1,000,000 for purposes of extension. The line is now worked between Converse and Muncie, Ind., 43 miles.

CHICAGO & NORTH WESTERN.—The new Eau Claire, Chippewa Falls & Northeastern branch is being pushed as fast as possible for the first 35 miles, as far as Little Falls Dam, Wis. Work has been stopped on the portion of the line beyond this point by order of President Hughitt, and it is understood that it is proposed to change the survey for about 45 miles.

Surveys were begun Oct. 14 for the projected double tracking of the main line between Green Bay, Wis., and Fond du Lac, a distance of 65 miles, and it is said that grading will be begun this week.

The Verdigré-Bonesteel line of the Fremont, Elkhorn & Missouri Valley was opened for traffic from Verdigré to Bristow, Neb., 41 miles, on Oct. 14. (Sept. 19, p. 733.)

CHICKASAWBA.—This company filed articles of incorporation in Arkansas, Oct. 13, to build a railroad 10 miles long from Blytheville, Mississippi County, Ark., east to the Mississippi. Connection is made with the Jonesboro, Lake City & Eastern, running from Jonesboro to Blytheville. The headquarters of the new company will be at Jonesboro, Ark.

CONCORD-ROCHESTER (ELECTRIC).—A contract for 4,000 tons of 70-lb. rails has been let to the Pennsylvania Steel Co. by the Rochester Street Ry., for the proposed line between Concord and Rochester, N. H., by way of Dover, and it is said that work will begin on the line at once. The total distance direct between these three points is about 40 miles.

DAYTON, UNION & HUNTINGTON.—Grading has begun for this projected line in Indiana, which is eventually to connect Versailles, Ohio, with Huntington, Ind. For the present bids are being asked by James Williams, contractor, at Columbus, Ohio, for the first 70 miles between Union City, Ind., and Huntington.

DETROIT & MACKINAC.—According to most recent advices, 15 miles of right of way have been cleared on the proposed extension to Cheboygan and Mackinaw, Mich., and it is expected to complete the line as far as Cheboygan and possibly also to Mackinaw during 1903. Other changes made during the current fiscal year include a new stone and concrete passenger depot and a frame freight depot at Harrisville, and other improvements in the structures along the line. The Harrisville cut-off was put into service last December.

EL PASO & ROCK ISLAND.—Contract has been let to a Denver firm by the Alamogordo & Sacramento Mountain R. R., which is a portion of the El Paso-Rock Island Route, to build an extension five miles long from Cox Canyon, N. Mex., to a large timber tract. The work will be heavy, similar to that on the greater part of the main line. Grading will begin at once.

EVANSVILLE, BOONEVILLE & ROCKFORD ELECTRIC.—Rights of way have been asked by this company for their projected line between the points named in Indiana, and surveys have been begun. It is understood that the necessary capital has been secured to begin building at an early date. The distance direct between the points in the title is about 35 miles, and the projected route would parallel the Southern between Evansville and Booneville, approximately half the length of the new line.

FIVE FORKS-DANIELSVILLE (GA.).—The necessary stock to build a railroad from Danielsville, eight miles south, to Five Forks, on the Seaboard Air Line, has been subscribed. It is hoped that the road will be completed by spring.

FRANKFORT-KOKOMO.—Organization of a company to build between these points in Indiana, by way of Lafayette and Logansport, is reported. The projected distance is about 80 miles. R. S. Vivian, of Chicago; Wm. Karoly, of Aurora, Ill., and others, are interested.

FRANKLIN-SIDNEY (N. Y.).—A company was organized Oct. 14 to build a railroad between these points in Delaware County, N. Y., 15 miles distant. The franchise is held by a company of which H. B. Oakman, of Brooklyn, is President, and the new syndicate will purchase this, and when the road is built, will receive a cash bonus of \$10,000, which has been raised by residents along the line. Work is to begin at once. Cleaver & Farnham, of Boston, may be addressed.

GEORGIA NORTHERN.—According to most recent advices, the extension into Albany, Ga., is now ready to be worked. The line has previously been in operation between Pidcock and Carlisle, Ga., 51 miles, and the Albany extension adds about 20 miles more. The track of the Atlantic Coast Line will be used for 2½ miles out of Albany.

GEORGIA ROADS.—Press reports state that a company known as the Vanderbilt, Timber, Mining & Southwestern is building a road 17 miles long from Tallapoosa, Ga., south towards Hopewell, Ala. Six miles of this have been completed and contracts will be let soon for the remainder. Geo. O. Vanderbilt is President.

GREAT NORTHERN.—Grading on the Chucanut cut-off between Belleville and Whatcom, Wash., is now reported to be completed and the line ready for track laying. The distance over the new route is practically the same as formerly, but a steep grade is avoided. The line is 22 miles long.

GROVES & SANDRIDGE.—This company has been incorporated in Illinois, with headquarters at Chicago, to build from Groves, in Perry County, Ill., in a southerly direction through Perry and Jackson Counties, to a point at or near Sandridge, in Jackson County, a distance of about 25 miles. J. C. Willing, A. Plumberg and others, of Chicago, are the incorporators.

GULF & INTERSTATE (TEXAS).—Joseph P. O'Donnell, Receiver, writes that he is unable to furnish information in regard to the project of rebuilding the line between White's Ranch and Bolivar Point, Texas. He understands, however, that the present owners anticipate rebuilding the road in the near future. About 30 miles of track were destroyed by the storm in 1901. (June 20, p. 485.)

HOUSTON & TEXAS CENTRAL.—A local report says that surveys are practically completed for grade reduction north of Dallas, Texas, and that grading will begin in a short time.

INTERNATIONAL & GREAT NORTHERN.—Grading is reported begun on the new branch from Navasota to Madisonville, Texas, 44 miles, known as the Anderson branch. It is proposed eventually to continue the line as far as Waxahachie, a total distance of about 195 miles. Hugh Burns, Taylor, Texas, is the contractor. (Oct. 10, p. 785.)

JAMES BAY.—Purchase of rights of way for the first four miles on the northern extension of the line to Sudbury is reported and location is being made. At present only five miles of the line is completed between Quebec Siding, on the Canada Atlantic, and Parry Sound, Ont. It is said that contracts for the section from Parry Sound to the French River will be let as soon as surveys have been completed. (April 4, p. 258.)

LITTLE RIVER.—The 11-mile extension from Walland, Tenn., to the forks of the Little River was reported completed Oct. 8. The work was very difficult, as much of the road was built through rock. The purpose of the road, which was chartered in November, 1901, by A. W. Lee, of New York, and others, is to reach sawmills. J. J. Condon was the contractor.

LOUISIANA PURCHASE SYSTEM.—Amended articles of incorporation of the Duluth, Springfield & Gulf were filed last week in Iowa, changing the name of the company to the above, and providing for the building and purchase of steam and electric railroads, steamboats, wharves, etc. No further details as to the intentions of the company have been announced. H. N. Armstrong, Oskaloosa, Iowa, is President.

LOUISIANA R. R.—An officer writes regarding the project to build a new line from Cypress or Leesville, La., to New Orleans, running through Oberlin, New Iberia, Crowley and other points, that no surveys have yet been made or contracts let, but an election has been held at Crowley to vote a tax to aid the builders and the results of this are being awaited. Hampden Story, Crowley, La., is President. (Oct. 10, p. 785.)

MANISTEE & NORTH EASTERN.—An officer writes that track is now being laid on the new extension to Leelanau County, Mich., and that Provemont will be reached within a week, thereby putting 11 miles of new line in operation this fall. The extension from Provemont to Omena on Grand Traverse Bay, 10 miles beyond, will be built in the early spring, and passenger trains put on in ample time to handle all business to the summer resorts next season. P. R. L. Carl, Manistee, Mich., is President.

MEMPHIS, HELENA & LOUISIANA.—A profile of the route of this projected line in Arkansas was filed at Helena Oct. 10, by the attorney for the Missouri Pacific. It is proposed eventually to build a railroad over 200 miles long, with a number of branches, but the section in immediate contemplation runs from Latour to Trippe, Ark., a distance of about 80 miles. (April 25, p. 316.)

MINNESOTA ROADS.—It is said that work will begin soon on a new line from Nevis, on the Great Northern, which is to be built for over 15 miles northwest into timber this season. T. B. Walker and H. C. Akeley, who are interested in the Walker mills at Akeley, Minn., are interested.

MISSOURI, KANSAS & TEXAS.—It is said that arrangements have been made to build a cut-off across Williamson County, Texas, from Granger through Georgetown to the Travis County line, a distance of 30 miles. Preliminary surveys over this route were reported last April, at which time it was said that it was the eventual intention to reach Austin and San Marcos, a distance of about 75 miles. (April 25, p. 316.)

MOBILE & OHIO.—It is said that the line which this company intends to build from Houston to Okolona, Miss., may eventually be extended on to Memphis. Surveys have been completed between Houston and Okolona, 20 miles.

NATCHEZ & GULF.—This company has been incorporated in Mississippi to build from Natchez to Gulfport through Adams, Franklin, Lincoln, Pike, Marion, Pearl River and Harrison Counties, a distance of about 200 miles. The incorporators are J. W. Lambert, W. H. Shields and others.

NEW YORK, ONTARIO & WESTERN.—Contract has been let to Ira M. Ludington, of Rochester, N. Y., to double-track the section between the Neversink River, in Sullivan County, N. Y., to Cadonia, in Delaware County, a distance of 30 miles. The work on this part of the line is rather heavy. This is a portion of the proposed double-tracking of the line recommended to the directors in the last annual report of President Fowler. (Aug. 22, p. 664.)

NOVA SCOTIA ROADS.—Negotiations are reported in progress by J. B. Cann, President of the Mabon Coal & Mining Co., of Halifax, N. S., for the purpose of placing contracts for rolling stock, etc., to be used on a new road which is projected to run from the Mabon mines, in Cape Breton, to Sydney, a distance of about 80 miles, connecting the Richmond & Inverness and the Colonial Railroads.

OAKLAND & SAN JOSE (ELECTRIC).—According to most recent advices, this company, which proposes to build an electric line between the points named in California, with three branch lines, making a total of 83 miles, has succeeded in placing enough bonds so that work can be begun. The company filed articles of incorporation in November, 1901. The projected road parallels the Southern Pacific between Oakland and San Jose.

OCEAN R. R. (LOUISVILLE & NASHVILLE).—Application has been filed in Tennessee by officers of the Louisville & Nashville, to incorporate a railroad with the above title, to run from Isabella, on the Atlanta, Knoxville & Northern, into the northern part of Georgia for a distance of 30 miles, intersecting the Atlanta Northern and serving as a cut-off which will reduce the distance on the Atlanta & Northern between Knoxville and Marietta by 20 miles. The length of the new line will be about 30 miles.

OCOEE VALLEY.—This company has been chartered in Tennessee to build a railroad 18 miles long, in a southeasterly direction from Wetmore, Polk County, Tenn., to Copper Hill. The office of the company is at Knoxville, and the incorporators are J. L. Boyd, J. E. Lutz and others.

OKLAHOMA CENTRAL & ST. LOUIS.—This company was chartered at Guthrie, Oct. 15, to build a railroad, the projected length of which is 600 miles, from El Reno, Okla. T., to Joplin, Mo., and northeast from there to Jefferson City or St. Louis. The charter was secured by W. S. McCaul, of Kansas City.

PHOENIX & EASTERN.—An officer writes that the route of this projected line in Arizona is from Phoenix, through Tempe and Mesa, thence southeast to the Gila River opposite Florence, Ariz.; thence up the Gila and San Pedro rivers to Benson, a distance of 180 miles. The contract for the first 25 miles has been let and surveys have been completed. Grant Bros., of Los Angeles, will do the grading and the other work will be done by the railroad company. The grading began about 10 days ago. Part of the work is rather heavy, involving three steel bridges across the Salt and Gila rivers. F. M. Murphy, Prescott, Ariz., is President, and W. A. Drake is Chief Engineer. For map of the route as projected, see our issue of Feb. 7, p. 104.

PITTSBURGH & LAKE ERIE.—An officer is quoted as saying that plans for 1903 involve double-tracking the two up-river divisions from McKeesport to Fayette City, Pa., on the Youghiogheny Division, and to Brownsville, on the Monongahela Division. Work on the extension to Brownsville is progressing favorably. Material for the new double tracking is now being received.

RIO YAQUI.—The Rio Yaqui International Transportation & Metallurgical Co. has been organized by ex-Governor Chas. T. Thomas and others of Denver, Colo., and will, it is said, build a railroad in the Rio Yaqui Valley, Mexico.

ROCHELLE & SOUTHERN.—See under Chicago, Milwaukee & St. Paul, Railroad News.

SANTA CRUZ, CAPITALA & WATSONVILLE.—This company has been incorporated in California to build a railroad 22 miles long between Santa Cruz and Watsonville, W. R. Porter, of Watsonville, Cal., may be addressed.

SAN PEDRO, LOS ANGELES & SALT LAKE.—Press reports state that Senator Clark, of Montana, and his associates, will build from a point on the above line to Port Stillwell, Mexico, passing through Jerome, Ariz., where Senator Clark has mines. Preliminary surveys

on the Mexican end of the line are reported from Hermosillo, Mexico.

SOUTHERN.—An officer is quoted as saying that work will be begun within a few weeks on the projected extension from Harrodsburg to Danville, Ky., 10 miles.

SOUTHERN PACIFIC.—Papers have been filed by this company at San Bernardino, Cal., asking condemnation privileges by which it can extend its tracks to that city from Colton, some four miles distant. Rights of way have been secured.

The new line between Wadsworth and Brown, Nev., 55 miles, was put in operation Oct. 19.

SEABOARD AIR LINE.—Contracts for the connecting link, 39 miles long, between the East & West R. R. at Coal City, Ala., and Birmingham, have been let to L. R. Wright, of Macon, Ga.; W. Z. Williams, B. O. Watkins, of Birmingham, Ala.; J. B. MacAfee, of Philadelphia, and Brewer & Jones, of Birmingham. Contracts provide that the grading shall be completed by the first of July. Work has been begun. (Oct. 3, p. 765.)

ST. LOUIS & GULF.—It is said that a branch will be built from a point north of Bloomfield, Stoddard County, Mo., to a point between Calagon and Campbell, in Dunklin County, a distance of 35 miles. (July 25, p. 600.)

SUFFOLK & CAROLINA.—An officer writes that the press report printed last week to the effect that a syndicate composed of the International Trust Co., of Baltimore; J. W. Middendorf & Co., Baker, Watts & Co., and W. C. Sedon, would finance the proposed changes contemplated, which include broad gaging the line, which is 51 miles long, and building a 25-mile extension to Elizabeth City, N. C., is correct. Details of building and equipment, however, have not as yet been fully determined. Geo. L. Barton, Suffolk, Va., is General Manager.

TACOMA EASTERN.—Grading is reported in progress on a new line between Holz and Eatonville, Wash., a distance of six miles. Seventeen miles of track were laid on the line during 1901 between Johnson's and Kapousen.

TEMISKAMING & NORTHERN ONTARIO.—Work has been begun on the first 11 miles of this projected line. The contract was reported let in our issue of Oct. 17. (Oct. 17, p. 806.)

TRANS-CANADA.—A contract has been let to Colonel G. E. Church, of London, Eng., to build about 400 miles of this projected line from Roberval, Que., the terminus of the Quebec & Lake St. John Line, to the mouth of the Nottaway River on James Bay. The contract is understood to be provisional on certain aid being furnished by the Government. R. Gardiner, of Quebec, is secretary of the executive committee of directors. (Sept. 19, p. 734.)

TREMONT & GULF.—Incorporation has been granted this company to build from Tremont, La., south to a point near Eros, in Jackson Parish. Robert H. Jenks, Tremont, La., may be addressed.

TRINITY & BRAZOS VALLEY.—Charter for a line with this name, to be built from Cleburne to Beaumont, Texas, 300 miles, was filed at Austin, Oct. 17. J. C. McDowell, of Pittsburgh, is interested.

VANCOUVER & COAST KOOTENAY.—At the next session of Parliament incorporation will be asked for a railroad to run from Vancouver, B. C., to Midway, which is about 200 miles east in a direct line. The plans of the projectors also include branch lines.

VIRGINIA ROADS.—Surveys for short branches to coal lands are reported from Crab Orchard, Va., to the Intermont Junction of the Virginia Southwestern and the Louisville & Nashville, and also from Crab Orchard to Harlan, Ky.

WESTERN ALLEGHENY.—Grading commenced Oct. 1 on this new line incorporated last April to build from a point on the Bessemer & Lake Erie, near Euclid, in Butler County, Pa., to Pfaff's mines, 38 miles. The Broadhead Contracting Co. and others are contractors. James H. Beal, of Pittsburgh, is President. (April 18, p. 296.)

YOUNGSTOWN & SOUTHERN.—The organization of this company, which filed articles of incorporation in Ohio, July 3, was perfected, Oct. 14, by the election of former Lieutenant-Governor A. W. Jones as President, R. L. Andrews as Vice-President and General Manager, and other officers. It is proposed to build a line 25 miles long from Youngstown to Columbiana. (July 11, p. 562.)

GENERAL RAILROAD NEWS.

ABERDEEN & ROCKFISH.—Sale of this property to E. W. Shedd, representing Boston capital, is reported. The Aberdeen & Rockfish runs from Aberdeen, N. C., to Rockfish, a distance of 33 miles, with a six-mile branch, and it is understood that it will form a portion of a through line from Concord, N. C., to Fayetteville, to be known as the Moore County & Western.

ALBANY & HUDSON.—The reorganization committee have drawn up a new plan replacing that announced in our issue of April 4, p. 258. The plan of Oct. 9, as outlined by the *Commercial and Financial Chronicle*, calls for the deposit with the Colonial Trust Co., of New York, of the existing securities, comprising \$2,500,000 each of stock and 5 per cent. bonds, and also of the 5 per cent. notes given for coupons due in September, 1901. The following new securities are to be created: First mortgage 40-year gold bonds bearing interest at the rate of 4 per cent. during the first three years, and 5 per cent. thereafter; total authorized issue, \$2,000,000, of which \$1,500,000 are issuable as part consideration for existing bonds, reserved to provide for future extensions, improvements and betterments under restrictions to be set forth in the mortgage, \$500,000; 5 per cent. non-cumulative preferred stock, preferred as to dividends and also as to assets in case of dissolution, all of which is issuable as part consideration for existing bonds, \$1,000,000; common stock entitled to all dividends after the payment of 5 per cent. on the preferred stock, \$1,000,000, of which approximately half may be issued in settlement of claims and the remainder reserved in the treasury. Each of the present bonds will be convertible into \$600 in new bonds and \$400 in new preferred stock upon a cash payment of not exceeding \$20 for each bond deposited. Operations for the year 1901-2 show gross earnings of \$159,260, other income of \$31,629, and total charges of \$191,996. Bringing forward last year's deficit the resultant total deficit was \$125,052.

ATLANTIC COAST LINE.—A special meeting of the stockholders will be held at Richmond, Va., Nov. 17, to complete the arrangements by which the Louisville & Nashville will be absorbed. The stockholders will vote upon a proposition to increase the common stock \$15,000,000, in addition to the \$23,150,000 now issued, making a total of \$38,150,000. It is also intended to increase the bonded indebtedness by \$35,000,000 collateral

trust purchase money, 50-year 4 per cent. gold bonds. For further particulars, see editorial article in our issue of Oct. 3, page 758.

BUFFALO & SUSQUEHANNA.—The annual report makes the following statement in regard to the Buffalo & Susquehanna Coal & Coke Co., mention of which is also made in the Construction Department. "The Coal & Coke Co., incorporated in 1901, had acquired, down to April, 1902, coal lands estimated by experts to be underlain with upward of 21,000,000 tons of bituminous coal of good quality. Included in the aggregate were purchases from Phelps, Dodge & Co. of lands containing at least 12,000,000 tons of coal in the vicinity of Medix, Pa. In June the company bought the large property owned by Peale, Peacock & Kerr, about 10 miles south of DuBois, Pa., containing more than 16,000,000 tons of bituminous coal of a superior quality. This tract adjoins the well-known property of the Rochester & Pittsburgh Coal & Iron Co., known as the Soldier Run Mine, which is the best mine owned by that company. The Buffalo & Susquehanna Coal & Coke Co. has also purchased from the Berwind-White Co. lands underlain by fully 14,000,000 tons of similar coal, located near DuBois. These veins will average more than 5 ft. in thickness. The plant of the Berwind-White Co. was taken over as a going concern. It is equipped in first-class manner, and is producing more than 1,200 tons of coal per day. The acquisition of these properties has placed the company in a strong position for the shipment of coal as soon as the railroad can be completed to the several mines. The new properties have all been paid for in cash since the close of the fiscal year, and are unincumbered."

CHICAGO, MILWAUKEE & ST. PAUL.—Purchase of 25,000 acres of coal lands in Illinois is reported at a cost of approximately \$2,000,000, and it is said that options are still being held on several thousand acres additional. It is understood that these lands are to be worked for the benefit of the St. Paul System solely, and that the company has no intention of engaging in the coal business. The new lands are located in what is known as the La Salle coal district in Putnam, La Salle, Bureau and Hennepin Counties. It is said that the Rochelle & Southern R. R., recently incorporated at Springfield to build from a connection with the Chicago, Milwaukee & St. Paul at Davis Junction, Ogle County, to McNab, 65 miles south in Putnam County, is to be worked by the St. Paul in connection with the new lands.

DENVER, NORTHWESTERN & PACIFIC.—The Colorado Utah Construction Co., contractors to build this projected line, which is to be approximately 500 miles long, offer bonds and stock for subscription. First mortgage 4 per cent. Denver, Northwestern & Pacific bonds are to be issued by the railroad company to the construction company under the provision of the contract at the rate of \$40,000 for each mile of main track as it is built, equipped, and turned over to the railroad for operation, and \$20,000 par value preferred stock, and \$20,000 par value common stock are given similarly. The authorized capital stock of the railroad is \$20,000,000, of which half is 5 per cent. non-cumulative preferred and the remainder common stock. The first mortgage to the Mercantile Trust Co., of New York, provides for an issue of not exceeding \$22,500,000 50-year 4 per cent. gold bonds. The Mercantile Trust Co., New York; the Providence Banking Co., Providence, R. I.; the Commercial Trust Co., Philadelphia, and the International Trust Co., of Denver, will receive subscriptions until Nov. 16, and each subscriber, as provided in the agreement, will receive for each \$950 paid, \$1,000 in the company's bonds, \$250 par value preferred stock and \$250 par value common stock. David H. Moffat, President of the railroad, states in the circular that his company is organized not to invade the territory of any other company, but to open to development a region in northwestern Colorado and eastern Utah larger than the State of Pennsylvania, which is now without railroad facilities. When the new road is completed, the distance over it between Denver and Salt Lake City will be more than 100 miles shorter than by any other route.

GRAND TRUNK.—The report for the half year ending June 30, shows gross receipts of \$2,377,201 as against \$2,287,795 for the first half of last year. After deducting \$1,603,612 operating expenses, net earnings were \$773,589 as against \$743,183 for the first half of 1901, and total net revenue receipts amounted to \$875,175. After payment of fixed charges and \$253,026 in dividends on the guaranteed and the first and second preference stock, there remained a surplus of \$2,609 to be carried forward. Changes in the line during the year include the double tracking of an additional five miles between Hamilton and Niagara Falls, making a total of 30 miles of double track completed between these points, and it is understood that the remaining 11 miles will be finished during the present season with the exception of certain bridges. The double tracking of the line between Port Union and Oshawa, 15 miles, has also been completed, leaving only 29 miles of single track between Montreal and Toronto, and it is said that this will be double tracked before the close of next season. Statistics of operation follow:

	1902.	1901.	Increase.
Miles worked....	3,555	3,552	3
Pass. train-miles....	3,315,697	3,313,169	2,528
Passengers carried....	3,525,855	3,205,441	320,414
Freight train-miles....	4,522,674	5,250,887	728,213
Tons moved....	5,675,338	5,613,613	61,725
Ton-miles.....	1,254,975,835	1,244,481,637	10,494,198

HUDSON VALLEY (ELECTRIC).—As a result of a long continued strike, controlling interest has changed hands and John W. Herbert, of Helmeta, N. J.; Geo. H. Helme, of New York, and Geo. B. Wilson, of Philadelphia, have purchased a controlling interest in the stock.

ILLINOIS CENTRAL.—At the annual meeting of the stockholders Oct. 15, it was voted to purchase the railroad property, corporate rights and franchises of the following companies now operated by the Illinois Central: Chicago, Madison & Northern; Kankakee & Southwestern; Chicago & Springfield; Mound City; St. Louis, Alton & Terre Haute; Chicago & Texas; Chicago, Havana & Western; Rantoul, Illinois & Indiana, and Riverside & Harlem. The aggregate mileage of these companies is 1,091 miles.

KENT NORTHERN.—Purchase of this line, which runs between Kent Junction, on the Intercolonial, and Richibucto, N. B., 27 miles, is reported by a syndicate of local capitalists of whom F. W. Sumner, Moncton, and Chas. Fawcett, Sackville, are chiefly interested. It is understood that the intention of the new owners is to bond the line for \$270,000 and make extensive repairs.

LONDON UNITED ELECTRIC.—At the session of the House of Commons on Tuesday, Oct. 21, Sir Edward Clarke as counsel for the London United Electric Railways, withdrew the bill providing for the building of the road. This line has previously been counted in as a portion of the Morgan System and traversed the district between Hammersmith and Piccadilly westward and southward between Clapham and the city. The Morgans originally intended to cover these points but the London United was in possession of certain powers so that it remained under its own title. By the passing of control of this portion of the line to Chas. T. Yerkes, the demand was made by the Yerkes interests that the Piccadilly & City Line must also be withdrawn on the ground that it had no legal status because it was presented to Parliament as a portion of the London United Line, which at the present time was non-existent. Decision on this point was postponed until a later date.

LOUISVILLE & NASHVILLE.—The Interstate Commerce Commission has received a communication from the Kentucky Railroad Commission complaining of the merger of the Atlantic Coast Line, the Louisville & Nashville, the Southern, the Cincinnati, New Orleans & Texas Pacific, and the Chicago, Indianapolis & Louisville railroads. It is alleged that J. P. Morgan has obtained the control and management of all these lines and that such action is in violation of the Interstate Commerce Act. The commission is asked to investigate and ascertain the purpose of those in the agreement and find out what will be the consequences of such a combination. It is alleged that Morgan & Co., for themselves and others connected with them, as trustees for the Southern, have entered into combination with the Louisville & Nashville, getting control of the Chicago, Indianapolis & Louisville for the benefit of the other two companies. The complaint declares the purpose of the merger of these railroad interests to be to destroy and throttle competition and to regulate and control rates in all the territory south of the Ohio and east of the Mississippi River. It is alleged that the defendant companies have not filed with the Interstate Commerce Commission, as required by law, copies of the contracts, agreements, etc. It is charged that such arrangements, combinations, purchase and sale, for the producing of what is called a "community of interest," is simply an agreement or combination, by which all freights of all roads named shall be pooled or controlled or routed so as to prevent competition. As a result, the rates will be advanced and communities discriminated against.

LOUISVILLE & WESTERN.—This company was incorporated at Columbus, Ohio, Oct. 17, as a reorganization of the Columbus, Sandusky & Hocking, which formerly worked 270 miles of line between Fair Grounds, Sandusky, Columbus and Shawnee, Ohio, and was sold on Sept. 24 to a New York syndicate represented by Paul D. Cravath. Under the reorganization the Hocking Valley will have control of that portion of the line between Zanesville and Columbus. The north end of the former system will be taken over by the Pennsylvania.

NORTHERN PACIFIC.—Purchase of the Bellingham Bay & Eastern R. R., which extends from Wickersham to Fair Haven, 23 miles, has been completed by the above-named company. The price was \$495,000.

NORTHERN SECURITIES.—The United States Supreme Court on Oct. 14 granted counsel for the Northern Securities Co., and for the Northern Pacific and Great Northern roads, 30 days' time to demur, plead or make answer in the proceeding of the State of Washington. Former Attorney-General Griggs, on behalf of the Northern Securities Co., first made answer to the motion of the State of Washington to file a bill of complaint, last April. Answers against the suit brought by the State of Minnesota were filed in the office of the United States Circuit Court at St. Paul Sept. 1, the Supreme Court having refused to take jurisdiction in this case. (Feb. 28, p. 154; April 18, p. 296.)

OREGON SHORT LINE.—It is understood that the three charters of the Oregon Short Line, the Utah & Pacific and the Utah, Nevada & California, under which the line is worked from Salt Lake, will be consolidated and that legal steps to this end will shortly be taken.

PENNSYLVANIA.—The Pennsylvania Midland, a partially completed line between Cessna and Imber Valley, Bedford County, Pa., eight miles, which was recently purchased by the Pennsylvania, has been reorganized under the name of the Bedford & Hollidaysburg, with a capital stock of \$300,000. John M. Reynolds was elected President and announced after the meeting that the Pennsylvania would continue the building of the line in the immediate future, provided property owners along the route are sufficiently interested to give the right of way. The property and franchises are now in shape for the first time in eight years so that they can be used as a connecting link between Bedford and Hollidaysburg, Pa. The entire line is reported to be graded and over 12 miles laid with rails. (Oct. 3, p. 766.)

SOUTHERN.—J. P. Morgan, Chas. Lanier and G. E. Baker, voting trustees, announce that a majority of stock trust certificates having been stamped as assenting to the agreement for the extension of the voting trust until Oct. 15, 1907, the agreement has become operative. The time for stamping the certificates is extended until further notice. (Sept. 26, p. 750.)

VIRGINIA & SOUTHWESTERN.—A mortgage for \$2,000,000 to protect a loan from the Morton Trust Co., was filed in the office of the clerk of the Corporation Court at Bristol, Tenn., Oct. 15. The mortgage represents the present bonded indebtedness of the company, which is at the rate of 5 per cent. interest. The Virginia & Southwestern extends from Bristol, Tenn., to Inman, 70 miles. Grant B. Schley, 80 Broadway, New York, is President.

WEATHERFORD, MINERAL WELLS & NORTHWESTERN.—This road, which runs from a connection with the Texas & Pacific and the Gulf, Colorado & Santa Fe at Weatherford, Texas, to Mineral Wells, 25 miles, has been acquired by the Gould interests. Geo. J. Gould has been elected President, in place of L. M. Fouts. L. F. Thorne, Vice-President, and J. W. Boot, the present Secretary and Treasurer, has been re-elected to that position. The line will hereafter be worked by the Texas & Pacific.

WESTERN MARYLAND.—At a meeting of the stockholders, Oct. 14, it was voted to increase the common stock to an authorized amount of \$60,000,000, consisting of 1,200,000 shares, par value \$50. It was also voted to authorize the issue of bonds and the execution of mortgages to secure them. For particulars concerning the proposed capital changes, see our issue of Sept. 19, p. 734.